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Champion Dependable Spark Plugs

were used as equipment on the Roamer, using a Duesenberg Motor, when it established the world's stock chassis record of 105.1 miles per hour at Daytona, Florida, on April 22d, 1921.

Champion indestructible "3450" insulators and patented copper asbestos gasket construction again prove their dependability in this record-breaking performance.

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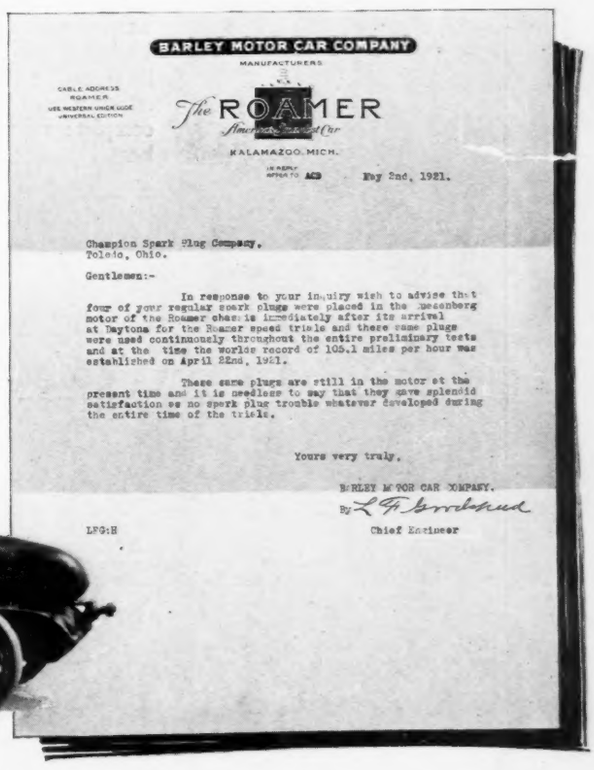


BARLEY MOTOR CAR COMPANY
MANUFACTURERS

CABLE ADDRESS ROAMER
USE WESTERN UNION CODE UNIVERSAL EDITION

The ROAMER
American Quality Car

KALAMAZOO, MICH.

IN REPLY REFER TO ACD May 2nd, 1921.

Champion Spark Plug Company,
Toledo, Ohio.

Gentlemen:-

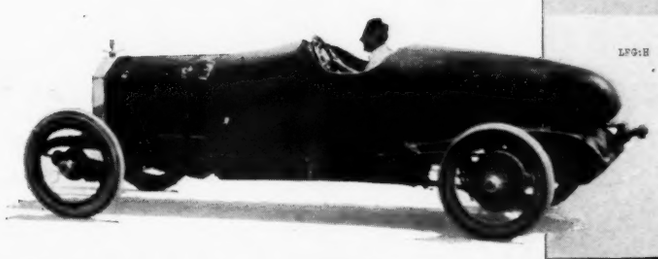
In response to your inquiry wish to advise that four of your regular spark plugs were placed in the Duesenberg motor of the Roamer chassis immediately after its arrival at Daytona for the Roamer speed trials and these same plugs were used continuously throughout the entire preliminary tests and at the time the worlds record of 105.1 miles per hour was established on April 22nd, 1921.

These same plugs are still in the motor at the present time and it is needless to say that they gave splendid satisfaction as no spark plug trouble whatever developed during the entire time of the trials.

Yours very truly,

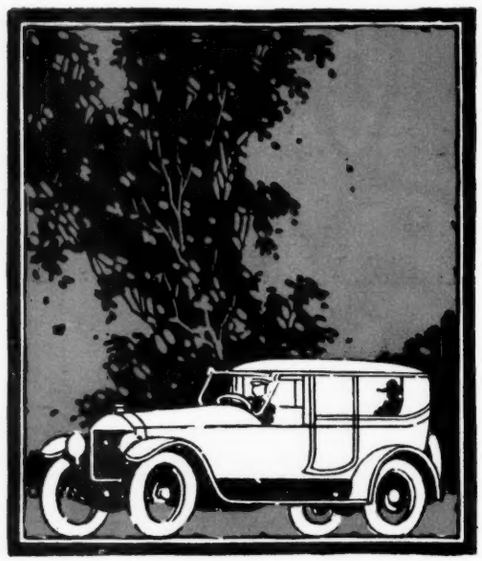
BARLEY MOTOR CAR COMPANY.
By L. F. Brookes
Chief Engineer

LFG:H



Champion Spark Plug Company, Toledo, Ohio

Entered as second-class matter Jan. 3, 1903, at the post office at New York, N. Y., under the Act of March 3, 1879.



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AUTOMOTIVE INDUSTRIES
The AUTOMOBILE

VOL. XLIV. NEW YORK—THURSDAY, JUNE 2, 1921 No. 22

S. A. E. SUMMER MEETING

S. A. E. Holds Another Important and Successful Meeting

Semi-annual gathering is well attended and highly profitable. Papers presented are of great educational and engineering value. B. B. Bachman, Standards Chairman, nominated for president.

WITH a surprise attendance—the total reaching 700—the recent meeting of the Society of Automotive Engineers at West Baden Springs, Ind., will be written into the records of the Society as one of the most profitable gatherings. It was anticipated early in the season that the attendance would be rather low compared with recent years, but the meaning of the attendance can be seen by comparing it with that of 1920, which was 757.

The program was an excellent one and the fuel papers and discussions marked an exceptionally high point of interest. An unusually large proportion of the men were present, interested to learn the advances that have been made in engine design and what is indicated by the research that is under way. Apparently most of the engineers in the industry realize the grave task that is before them in working to a higher economic standard. Without doubt the engineers are taking their work more seriously.

The social and sport side of the meeting was excellent. The hotel was commodious and few complaints were registered. The only drawback was the heat and the showers. Fortunately, all comers had experienced a taste of hot weather before leaving home and they were not inclined to blame the Southern Indiana location. The great atrium of the hotel furnished an ample playground on the wet days.

The nomination for president of B. B. Bachman, chairman of the Standards Committee, met with general approval. The other nominees for the various offices were as follows:

First vice-president, J. V. Whitbeck; second vice-presidents — representing Motor Car Engineering, F. E. Watts; Marine Engineering, H. E. Morton; Tractor Engineering, O. W. Young; Aviation Engineering, V. E. Clark; treasurer, C. B. Whittelsey. Councilors, two-year term, Lon R. Smith, C. F. Scott, H. M. Crane. Councilor, one-year term, W. R. Strickland.

This ticket will be voted upon by mail ballot of the membership and the vote canvassed at the annual meeting of the Society in January in New York. The constitution of the Society provides means for naming a second ticket if the regular ticket is not acceptable, but there has never been a contest.

Probably the greatest professional interest of the meeting, was in the paper on Turbulence, by Harry L. Horning, but W. S. James' paper on Elements of Fuel Economy was the subject of much favorable comment and would doubtless have resulted in as much discussion had it not been the last paper at the concluding session.

B. B. Backman, nominee for president.

The Combustion Session

THE combustion session was in many ways interesting and instructive. Grouping together some of the most advanced ideas on what is believed to take place in the combustion chamber of an engine cylinder, the meeting held forth a promise that the highest thermal efficiency possible with the Otto cycle may be realized in the near future.

The session was presided over by Thomas Midgley, and papers by H. L. Horning on Turbulence, C. A. French on Flame, and Sir Dugald Clerk on Cylinder Actions in Gas Engines were presented.

While the discussion showed that there are minor discrepancies in theory and in the interpretation of experimental results at the present time, there is, on the other hand, a remarkable unanimity of opinion on the general fundamentals which apply to flame and its propagation in the combustion chamber.

The discussions brought out the fact that the research work covered has produced many practical results. Increase in the thermal efficiency of automotive engines is not only possible, but in view of the information brought out it is clear that we are standing on the threshold of some very important commercial developments.

Horning Discusses Turbulence

Horning, in his paper on Turbulence, stated that since the subject was actively revived a little more than a year ago, considerable interest and experiment has resulted. The paper, which is printed in condensed form below, is the result of a collection of notes gathered from investigation of the subject in the literature covering past work and also from a large number of experiments conducted under the author's observation.

Turbulence hastens the contact of two substances in a semi-liquid, liquid or gaseous state. Le Chatelier and Mallard noted its effect in their classic investigation of flame propagation. Wheeler and Mason noted a doubled flame velocity in a closed tube as compared with a quiescent mixture. Prof. Bertram Hopkinson noted an increase in flame velocity in a closed vessel when a fan was used to promote turbulence, and Sir Dugald Clerk in 1912 showed that where turbulence is employed there is a noteworthy increase in the speed of pressure development. This increase under the conditions of the experiment reaching 150 per cent.

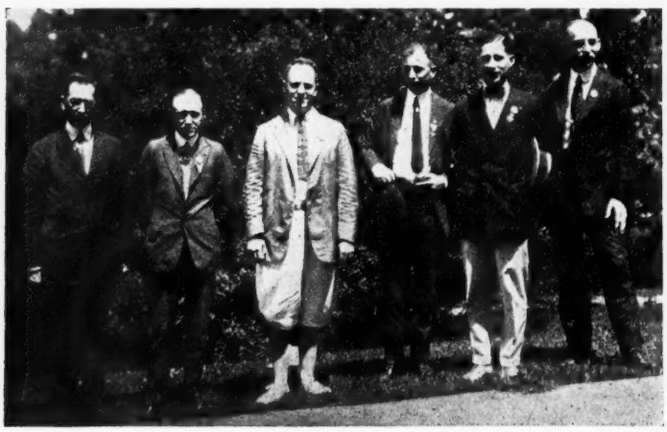
Harry Ricardo has studied turbulence in recent years and determined that with normal timing, gas velocities through the intake valves of from 130 to 160 ft. per sec. give the highest brake m.e.p., whereas velocities of 160 to 180 ft. give the maximum brake thermal efficiency and velocities of from 180 to 200 ft. give the maximum indicated mean effective pressure. Ricardo has also designed a number of efficient combustion chamber shapes to take advantage of turbulence.

President David Beecroft.

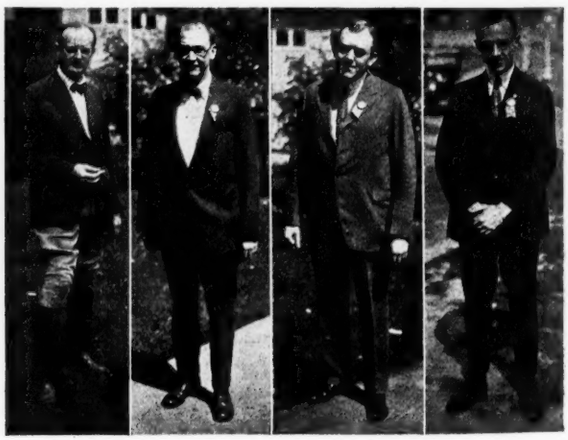
Horning also gives credit in his paper to Woodward, Lewis and Canby of E. I. Du Pont de Nemours & Co., the Bureau of Standards and P. S. Tice for investigations along this line.

An examination of a large number of flame photographs indicates that there are four phases of velocity in a tube of uniform cross section. The first phase is known as the phase of first acceleration. The second phase is one of uniform velocity. The third phase is that of second acceleration and the fourth phase is that of a high uniform rate known as detonation.

The first phase represents a condition which, if it were possible to continue it throughout the entire range would result in the highest efficiency. In this phase the flame is blue. In the second phase the flame becomes green. In the third and fourth phases the liberation of energy is so rapid that incandescence of some of the carbon particles occurs and rapid loss by direct radiation takes place. The second phase represents the combustion of the most economical mixtures at loads at and under those giving maximum economy, providing that there is no marked or incipient auto-ignition. This is at nearly full load performance and with lean mixtures in



Some members of Nominating Committee, left to right, R. E. Northway, A. W. Scarratt, H. W. Slauson, G. P. Dorris, Mark Smith, H. C. Dickinson.



Some Committee Members, Hugh R. Corse, Chairman Sections Comm.; John R. Cautley, Meetings Comm.; H. G. McComb, Meetings Comm.; C. F. Scott, Chairman Meetings Comm.

Sport and Social Events

Photographs by Lazarnick

(1) The meeting place. (2) Men's 50-yard dash. (3) Ladies' clock golf tournament. (4) Ladies' 25-yard dash. (5) Shot put. (6) H. A. Coffin, Chairman of Sports Committee. (7) Three-legged race. (8) H. L. Spohn, in charge of social events.

low compression engines. This phase is not characterized by a roughness in the performance of the engine. The third phase is obtained in an engine having a compression just low enough to avoid detonation at the most economical mixture but running with a richer mixture. This may be also representative of an engine running where the compression ratio is somewhat too high for available fuels. It is typical of the large class of cars built in the past for more volatile fuel. The fourth phase is characterized by very rough performance. In the third phase the flame is yellow and in the fourth it is brilliant white.

Since the usable velocity must not exceed that at the end of the second phase the problem boils down to securing a maximum area of flame in order to increase volume consumed in a given time. In other words, the design of a combustion chamber permitting rapid spread of the flame crest, developing at each successive advance an increasing area of contact with the unburned mixture.

By the use of turbulence in combination with ideal geometric form of combustion chamber exceptional economies can be obtained. There are three points which generally have a temperature above the average. These are the center of the piston, the center of the exhaust valves and various points in the spark plug. Turbulence tends to prevent the layers of gas over these points from reaching the point of auto-ignition.

Where these layers occur in shallow pockets there is less opportunity for turbulence to keep the gases moving and the high temperature of the mixture at these sections must be kept in mind in locating spark points, as it has been proved by many investigators that the spark plug should be placed in such a position as to ignite the hot portion of the mixture during the early stages of combustion when it is relatively cool rather than allow a flame traveling some distance to set this hot portion off by auto-ignition toward the latter part of combustion when temperatures and pressures are high and the maximum of radiant heat is flooding the combustion chamber. When three high temperature spots and a pocket claim the location of the spark plug, it is necessary to compromise, giving preference to that locality which will set off the hot sections in a pocket first and then the mixtures of lower temperature. Generally speaking, after the pocket is taken care of, the spark plug should be as near as possible to the greatest turbulence and the center of gravity of the mixture.

There are three spots where a spark plug should not be placed: at any point remote from a pocket; at any point remote from a hot surface; at a point where it will be washed by the exhaust and the pumping action of the rings.

Two Methods of Producing Turbulence

Turbulence is produced by two fundamental methods based on the means by which the circulation is initiated. The first and most common method is by means of the intake gas velocities. There is a fundamental defect in this method, inasmuch as it depends on a high gas velocity, which means relatively low volumetric efficiency.

Turbulence is produced primarily by the velocity of flow past the intake valves during the suction stroke of the engine, and secondarily through the subsequent flow of the gases on the compression stroke. The flow through the intake valve is at high velocity but discharging into a relatively large chamber the velocity tends to drop abruptly due to the volume of the space and particularly to its shape. The turbulence which may be developed during the suction stroke is particularly susceptible to the dampening influences that generally exist during the compression stroke when the gas is being forced into a smaller space, and at this period the persistency of turbulence is particularly subject to the influence of combustion chamber shape. Whatever the natural direction of the gases, the shape of the head and all parts of the chamber should be such as to introduce no irregularities into the path. The flow during entry into the cylinder should induce a high velocity and symmetrical course of the gases after the valve is closed, this path merely lengthening or shortening, but keeping its general course when the piston is at its various positions. The energy available for turbulence is limited; hence the most regular and undisturbed paths tend to conserve the velocities. The moment of ignition is the moment of utmost importance. Whatever is done to produce or maintain turbulence must be done entirely in reference to the moment of ignition, for it is the turbulence at this instant which determines the distribution of flame throughout the cylinder.

Turbulence Due to Intake Velocity

In engines depending on intake gas velocities for turbulence there is always a restricting influence in the compromise between high turbulence and volumetric efficiency, and this points to a more effective and convenient method of producing turbulence. Fig. 1 shows a design which is due to Ricardo. This design was developed by him after he had observed the very effective way in which the design shown in Fig. 2 handled kerosene in his tank engines with a relatively high compression without a knock. It was almost impossible to make this engine knock on kerosene at compression ratios of 4.75-1. It is obvious that in this design turbulence is set up at the proper moment through the velocity produced by the piston forcing almost the entire cylinder contents past the opening between the cylinder proper and the valve chamber. This opening need not be restricted to produce high initial velocities, for there is no intervening time for the turbulence to die out before the spark passes; in fact the design can be worked out so that the turbulence is reaching its very maximum when the spark passes. In this form the great problem is the flat section between the piston and the cylinder head, which gives opportunity for the flame to run and knock from auto-ignition. From a turbulence standpoint this form is very effective and it can also be made so as to have a very favorable area-to-volume ratio. It is very favorable because of its compactness for an effective spark location. By making the combustion chamber a hemisphere the most compact form possible is introduced.

There is still another way in which turbulence can be produced, namely, by forcing the contents of the cylinder at high velocity through a venturi of small area into the combustion chamber on the compression stroke. Fig. 3 illustrates this for a valve-in-head engine and Fig. 1 for an L-head engine. Fig. 4 illustrates still another development. The fundamental difference between these methods and those met with in conventional systems is, first, that compression backed up by the piston furnishes a much more positive means for causing turbulence than the atmospheric pressure during the suction stroke; second, gives an opportunity for producing a much more general movement of the gases and, third, turbulence occurs immediately before and during ignition, thus obviating its dying out. The defect of these systems is the increase in combustion chamber area and the introduction of thin layers of gas at some points. So far as the main chamber is concerned there can be no detonation, but unless highly stable fuel is used there will be detonation in the shallow sections over the pistons. The main combustion chambers of these forms have a relatively small area-to-volume ratio.

Turbulence produced by piston compressions is the most

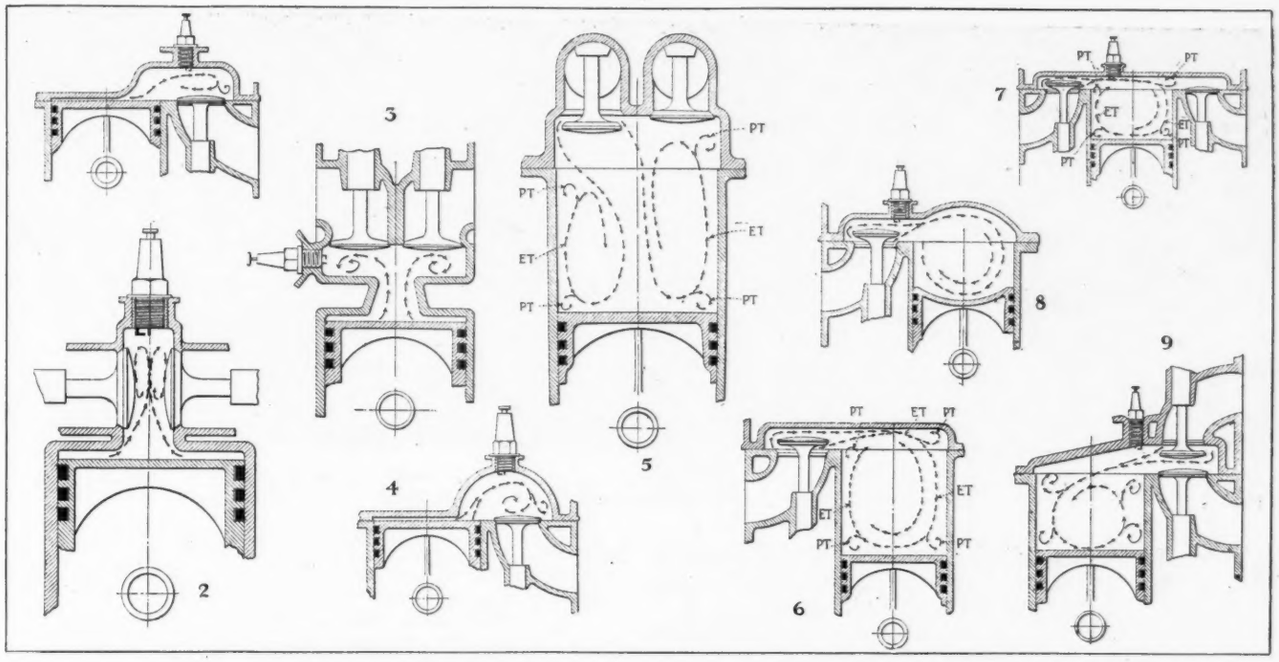


Fig. 1—Cylinder Designed by Ricardo

Fig. 2—Design Which Used Kerosene as Fuel in the Ricardo Tank Engine

Fig. 3—A Design of a Valve-in-Head Engine Which Produces Turbulence by Forcing the Contents of the Cylinder at a High Velocity Through a Venturi of Small Area Into the Combustion Chamber on the Compression Stroke

Fig. 4—Another Development to Secure Turbulence in the Valve-in-Head Engine

Fig. 5—Diagrammatic View of the Cylinder of an Overhead Valve Engine Showing the Path of the Major Currents in the Gas

Fig. 6—An Ordinary Type of L-Head Combustion Chamber

Fig. 7—The Usual T-Head Type Engine Which Must Be Run at High Speed to Get Sufficient Turbulence for a High Mean Effective Pressure and Thermal Efficiency

Fig. 8—Another Form of Combustion Chamber Design by Ricardo

Fig 9—High Speed is Usually Required to Give Sufficient Turbulence for the Maximum Mean Effective Pressure and Thermal Efficiency in this Type

effective known for a given speed of engine. The gas must go through two passages, the valves and turbulence orifice, on the suction stroke; therefore, large areas at these points are advisable and permissible to sustain volumetric efficiency. However, because of the effectiveness of the method and the simplicity of flow and high velocities of the mixture at the moment of ignition, it is doubtful whether such high velocities of mixture through the turbulence orifice are needed as have proved necessary when producing turbulence by intake gas velocity in normal types of combustion chamber.

Figs. 5, 6 and 7 are marked *ET* to show points of effective turbulence. The paths shown indicate the major currents in the gas and should be provided for by design. They represent the greatest velocities and should involve a high percentage of the total mass of the mixture. The most effective turbulences are those involving the entire mass of the mixture in a general movement of highest velocity and along one simple course. This involves less loss in velocity and minimizes the eddies which generally may be considered as parasitic turbulence, marked *PT*. Since these eddies derive their energy from the main stream, they impede it. They are also of lower order of velocity and therefore less effective.

In engines of a design depending on intake gas velocities for turbulence the proper combustion chamber is that which follows most closely the lines of flow of the mixture. Such a form is illustrated in Fig. 8. Another form is shown in Fig. 9 in which the path of turbulence is indicated.

Characteristic Turbulence in Typical Cylinders

Fig. 5 shows diagrammatically the general currents in an overhead valve engine of well known design. It is obvious that when the contents are compressed the contending currents will tend to wipe themselves out; this is the reason why overhead valve engines take higher gas velocities to attain maximum brake mean effective pressure, brake thermal efficiency and indicated mean effective pressure. This type is the least effective from a turbulence standpoint. Fig. 6 shows an ordinary flat type of L combustion chamber, the eddy currents illustrating how ineffective it will be. The large area volume ratio makes it ineffective. This type will have low mean effective pressure and thermal efficiency. Fig. 7 is the usual T-head type which must be run at high speed with spark plug located as shown to get sufficient turbulence for a high mean effective pressure and thermal efficiency.

Fig. 8 shows a form of combustion chamber which Ricardo claims to have used on his design of the Mark Webber engine. While the reported results are remarkable we have never attained satisfactory results with the spark plug placed over the piston as shown in his reports. In fact, we always had very severe knocking.

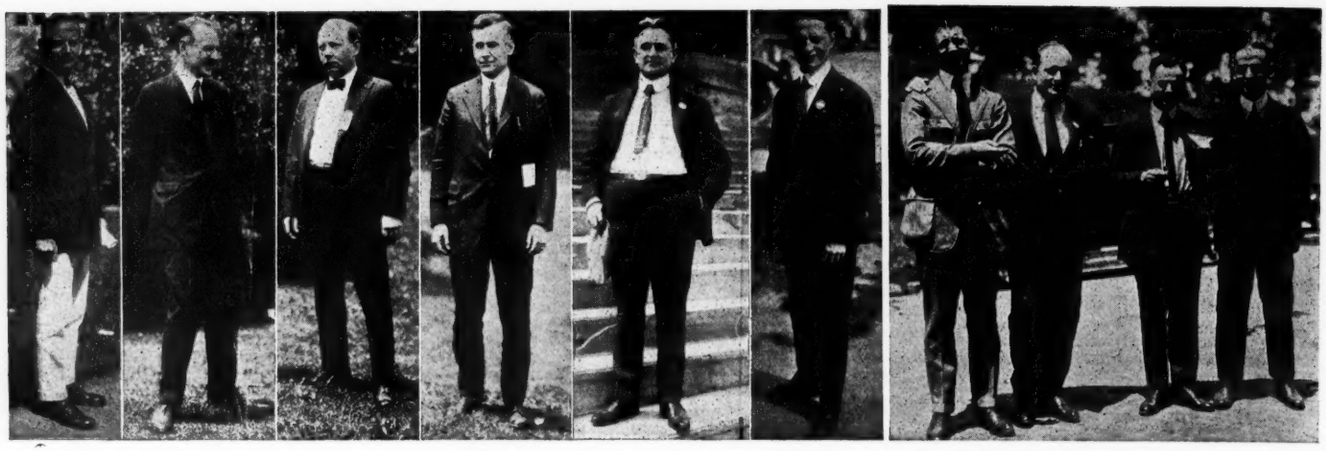
Fig. 9 is a type which has shown good results when the piston and head are like those illustrated in Fig. 8, but as shown here usually requires high speed to give sufficient turbulence for maximum mean effective pressure and thermal efficiency.

Fig. 1, Ricardo L-head type, gives a high turbulence and excellent brake mean effective pressure and thermal efficiency at all speeds and with a very small spark advance.

Fig. 4, the Tyler type, in which the combustion chamber is hemispherical in form, gives excellent results.

Fig. 2, Duesenberg type, is the same as that used in Ricardo's tank engine and the Bugatti aeronautic engine. It is very fine from the turbulence standpoint, gives high mean effective pressure and economy at all speeds and takes a relatively small spark advance.

Fig. 3 shows a turbulent overhead valve type in which



Al. Reeves | O. W. L. Coffin | A. J. Scalfe | E. W. Templin | M. L. Heminway | B. G. Koether | R. E. Mackenzie, H. L. Spohn, C. S. Hyman, H. S. Downe.

the piston forces the cylinder contents into the combustion chamber at high speed and thus makes it one of the best types from a turbulence standpoint.

While turbulence tends to cause an increase in the direct heat loss, it decreases the dissociation losses and those due to after burning are brought to a minimum. With a rapid combustion resulting from turbulence it may be expected that the ignition need not be advanced as far as usual. This is found to be true and the spark advance may, all other conditions being equal, be considered an excellent index to turbulence. That is to say, with the same compression ratio, gas velocity, fuel-to-air ratio and volumetric efficiency, the spark advance in degrees may be considered inversely proportional to the combustion efficiency.

We have found it possible to attain with a combustion chamber of L-head type, of the general shape shown in Fig. 8 with cast iron walls, an efficiency of 64 per cent of the air cycle efficiency, as against 54 per cent with a shape approximately like that shown in Fig. 6. With a similar engine of valve-in-head type and at slightly higher compression ratio, we secured an efficiency of 65 per cent of the air cycle efficiency under laboratory conditions with a gas velocity of 170 ft. per sec. and a relative efficiency of 56 per cent with a speed of 110 ft. per sec. and slightly inferior carburetion.

The relatively poor turbulence is markedly shown in the greater spark advance required in a valve-in-head engine, and the high combustion efficiency due to turbulence is shown in the low spark advance in forms of combustion chamber in which the turbulence is highest, such as the high valve pocket L-head design (see Figs. 2, 4 and 8).

We have found a spark advance of 64 deg. necessary in a valve-in-head engine of 4 to 1 compression ratio having a gas velocity of 110 ft. per sec. with a poor carburetion efficiency running at 1000 r.p.m. with a 15 to 1 air-to-fuel ratio.

We have found a spark advance of only 11 deg. necessary on an L-head engine of the high valve pocket design at the same speeds and conditions as specified for the valve-in-head engine above. In this case the relative efficiency was very high, offsetting a low compression ratio.

Conclusion

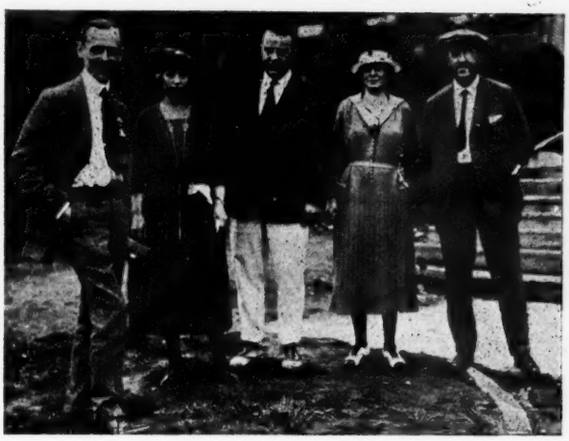
The effects of turbulence upon performance may be summarized as follows:

(1) By developing high turbulence in a mixture it is possible to drive off the surface layers of the combustion chamber and thus force their full contents to contribute to the heat and pressure before the expansion-stroke commences. The fundamental conception of the constant-volume cycle is based on the working fluid receiving all its heat at constant-volume and instantaneously. Neither of these conditions is attainable for obvious practical reasons; however, the wide departure from this ideal with slow-burning mixtures, great spark-advance, low maximum pressures, bad after-burning during expansion, hot cooling-water and exhaust pipes are marked symptoms of low turbulence, and result in low combustion efficiency. Since the air-cycle efficiency is constant in any case, a high combustion-efficiency means a high thermal efficiency and since the indicated mean effective pressure is the product of the indicated thermal efficiency, the volumetric efficiency and the energy content turbulence is directly responsible for increased power.

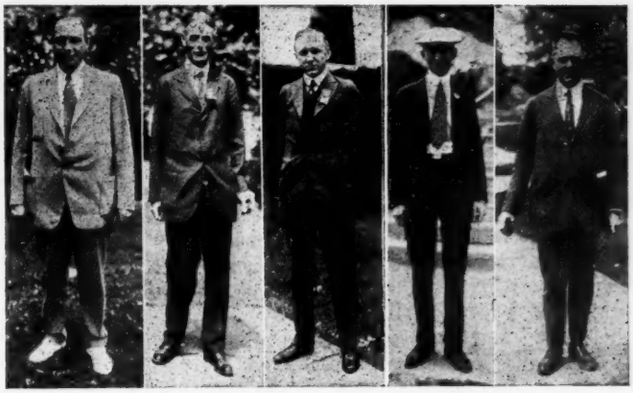
(2) Turbulence tends to hurry the combustion of the entire mixture volume without allowing any part to attain high flame-velocities manifested by pre-ignition, detonations or auto-ignitions within certain limits. These limits are difficult to express, there being no generally accepted scientific method for the purpose. Roughly speaking, the common fuels of 1915 and the spring of 1916 furnished by the Standard Oil Co. of Indiana were such as to allow a cylinder of the general form shown in Fig. 2 to run at a 4.6 to 1 compression-ratio without knock. Whereas, it is impossible to run with this shaped combustion-chamber with the present fuels without a knock at a compression-ratio of 3.7 to 1. With a combustion chamber of the shape shown in Fig. 3 it is possible to run on the present fuels produced by the above-named company with a 4.2 to 1 compression-ratio without knock, whereas with kerosene it is necessary to keep down to a 3.9 to 1 compression-ratio if it is desired to run without knock and without water-injection. These results are on a heavy-duty engine running at 1000 r.p.m., and with chemically correct mixture proportions. It is obvious that so far as compression-ratios are concerned we have not been able, under the above stated conditions, to offset entirely with combustion chamber design the decline necessary in compression-ratios to prevent knocking with present fuels.

(3) On kerosene-burning engines turbulence has made possible a combustion efficiency at fairly high compression-ratios without use of dopes, water or exhaust gases, giving an indicated thermal efficiency of 26 per cent and an indicated mean effective pressure of 80 lb. per sq. in. without special carbureter designs.

(4) Since the fuel of 1915 allowed a compression-ratio of 4.6 to 1, its air-cycle efficiency was 45.8 per cent. The 1921 fuels permit a 3.7 to 1 compression-ratio



B. B. Dachman | A. K. Brumbaugh | Mrs. H. L. Horning | H. L. Horning



A Group of Officers of the Society

E. A. Johnston | H. M. Crane | A. W. Scarratt | J. G. Vincent | Coker F. Clarkson

with an air-cycle efficiency of 40 per cent; therefore the decline in fuel value shows a loss of 14 per cent in efficiency due to a necessary drop in compression with old styles of combustion chamber. With new designs of combustion chamber, similar to those shown in Figs. 4 and 6, an air-cycle efficiency of 43.5 per cent is possible, cutting down the air-cycle loss due to fuel to 5 per cent. However, since 1916 we have improved the combustion efficiency from 54 per cent of the air-cycle efficiency to a possible 64, a gain of 18 per cent.

(5) Turbulence makes all high speeds possible by speeding up the flame propagation.

(6) Turbulence makes high speeds possible without an excessive advance of the spark, and with high mean effective pressure and high thermal efficiency.

(7) Due to turbulence, L-head engines of the form shown in Figs. 2 and 6 will be generally superior or at least equal to I-head engines with respect to knocking, all other conditions being equal, including compression-ratio, mixture ratio and volumetric efficiency.

(8) Turbulence has the effect of preventing knocking at a given speed equivalent to one-half a volume in compression-ratio, whereas dopes can improve the compression between three and four volumes, or an improvement of 7 per cent for turbulence against 33 per cent for dopes in air-cycle efficiency.

(9) Turbulence is indispensable to efficient combustion with dopes or without dopes. It is possible to wipe out entirely all the advantage of increased compression allowable with dopes by low turbulence effects.

(10) Flame propagation in combustion chambers is influenced by the following factors in order of their importance. (*a*) The chemical constitution of the fuel molecules. (*b*) Temperature. (*c*) Pressure. (*d*) Turbulence. (*e*) Mixture ratio. (*f*) Compactness and shape of chamber. (*g*) Location and number of points of ignition. (*h*) Some property of the spark. (*i*) Sound-waves in the mixture.

H. M. Crane, in discussion, stated that he has built both L-head and I-head engines with practically identical dimensions. He found that the I-head had just a slightly higher m.e.p. Owing to better turbulence the spark advance in the L-head did not need to exceed 25 deg., while in the I-head engine it had to be carried up to 65 deg. with one plug and with two plugs to 30 or 35 deg. Owing to the big spark advance on this engine it was really firing during the compression stroke.

Crane stated that in his belief the most effective turbulence to utilize is that secured on the compression stroke on the engine and not that due to intake velocity, because the latter soon dies away and is not active enough at the time of firing or near the top of the compression stroke.

Crane also pointed out that the action of the valve passage is to create a whirling vortex action which would interrupt the straight swirl spoken of by Mr. Horning as being desirable. He also stated that in some cases aluminum pistons help relieve detonation because the center of the piston is cooler. Another point noted by Crane is that there is a great difference in efficiency with two spark plugs in the overhead valve engine considered.

Professor Wilson of the Massachusetts Institute of Technology said that he doubted if turbulence greatly increased the number of molecular collisions. Mass motion does not affect the number of collisions, which follow a natural law. He said that in his opinion if anything had any effect it is eddying. On the other hand he thought that the dead pocket theory advanced in the paper is of great interest and value.

Mr. James of the Bureau of Standards stated that the presence of exhaust gases in the combustion chamber has a marked effect on combustion. Increasing the turbulence mixes the exhaust gas with the incoming charge and allows it to cut down the efficiency, while if the inert exhaust gases can be kept stratified on top of the piston and remain at rest conditions are better and there is not so much effect from the dilution of the charge.

In making comparisons between combustion efficiency and air cycle efficiency it must be remembered, said James, that the definition of air cycle efficiency involves eight assumptions. Air cycle efficiency is the efficiency of expansion. If we can burn the charge so rapidly that the peak of the combustion curve is close to the beginning of the combustion stroke and not late, we are getting the best results. The efficiency is dependent upon the fuel as well as on the cycle.

Hugo Gibson said that he was in general agreement with Mr. Horning. He brought up the point that the Knight engine, with its particular type of intake passage and smooth combustion chamber surface, had ideal conditions for smooth turbulence, and consequently had a minimum of eddy or parasitic turbulence. Regarding residual gases the smooth turbulence permitted allows of excellent results in mixing up the fuel, but the picture is spoiled because, he jokingly remarked, "Turbulence does not decrease knocking in the Knight engine because the Knight engine does not knock."

Answering Professor Wilson, Horning agreed with his ideas regarding molecular impacts, but said the object of turbulence is to increase the rapidity of combustion. Turbulence carries the flame into different parts of the mixture, thus creating new starting points for combustion. Since the entire mixture is rapidly inflamed the distance

(*Continued on page* 1157)

Fuel Research Session

MANY of those who attended the fuel research session which was held on Saturday morning regretted the fact that such important papers were scheduled for presentation so late in the meeting that the discussion was necessarily hurried. Many were unable to remain for this session. Nevertheless, the session was highly successful and enlivened by much timely discussion. O. C. Berry presided.

The first paper presented was that on Development of a High Compression Oil Engine by F. E. Ziesenheim, an abstract of which was published in last week's issue of AUTOMOTIVE INDUSTRIES. In introducing the speaker, Berry said that fuel is as necessary to the automotive industry as food is to the human race. Some people believe that the present generation need not worry about the supply of petroleum fuel, but others are of the opposite opinion. Some suggested solutions of the fuel problem are in the nature of a palliative while others are expected to effect a permanent cure.

Thomas Midgley, who opened the discussion, said that we could not hope to obtain more than 20 per cent of the liquid fuel needed for our internal combustion engines from the distillation of coal. He did not agree with the author of the paper that there was little hope for alcohol because it required as much heat to produce alcohol as could be gotten out of it; alcohol could be made with very little heat expenditure. On the other hand, he was not very enthusiastic about shale oil, as the best gasoline that could be made from shale oil would make the worst Mexican oil ashamed of itself. There is, he said, enough cellulose material grown in this country to produce alcohol sufficient to run all our automotive engines on, and it was therefore not even necessary to look to the tropics for the raw materials.

Diesel Pressures Not Higher Than Otto

Hugo Gibson said it was not necessary that a Diesel engine be made exceedingly heavy on account of the high compression pressures. You start with approximately 500 lbs. per sq. in. at the beginning of the power stroke and don't go above it, and this is not very much more than the pressures obtained in Otto cycle engines under full throttle conditions. In fact, under conditions of detonation we go even above it in Otto cycle engines. The problem of starting large Diesel engines can be easily solved by placing a friction clutch between the crankshaft and flywheel and bringing the flywheel up to speed first by means of an electric starter for instance, and then letting in the clutch. If the clutch holds well this method gives very satisfactory results.

W. G. Gernandt said the small high speed Diesel engine has been a hobby with him for some years. He had recently built a single cylinder, two-stroke engine of 2¾ in. bore which had a cylinder head thickness of 5/16 in., a wall thickness of ¼ in., a piston head thickness of 3/16 in. and a flywheel weighing 94 lbs. This engine burned gasoline, kerosene, distillate or fuel oil without change or adjustment. Its speed could be varied from 225 to 2250 r.p.m. by simply varying the amount of fuel injected, and there was absolutely no missing.

In reply to a question Mr. Ziesenheim said that the four cylinder Hvid engine built by the Pittsburgh Filter & Engineering Co. had as good distribution of the power between the cylinders as the regular Diesel engine. Mr. Brewer said that during the war he came in contact with Hvid engines belonging to the Shipping Board and they experienced great difficulty in keeping all cylinders working evenly.

Prof. Berry voiced the opinion that the Otto engine must always be the dominating type because we need the lubricating oil of crude petroleum for lubricating the world's machinery. There is no substitute for this lubricant, and the crude petroleum must therefore be distilled and cannot be burned as crude. Thomas Midgley, Jr., said that the biggest claim made for the Diesel engine was its high thermal efficiency, but substantially equal efficiencies can be obtained from the Otto engine if the compression is raised to a point corresponding to a compression ratio of 7 to 1. This is rendered possible by the use of anti-knock substances. He then gave some characteristics of several anti-knock chemicals, including ethyl iodide, ortho toluidine, di-ethyl celenide, and di-ethyl tolluride. Dr. Dickinson said that we must recognize that there are other lines of industry which demand a portion of the crude oil. In Mr. Ziesenheim's paper it had been shown that only about 28 per cent of the oil produced was converted into gasoline, and it was a mistake to assume that if an automotive engine was produced that would burn any kind of oil up to crude, this would render 100 per cent of the oil produced available for automotive purposes. The shipping interests have recently come to realize the value to them of burning oil under their boilers, with the resultant saving in shipping space. The shipping men can, he said, probably afford under present conditions to pay $10 per barrel of crude.

Mr. Mock observed that the Diesel engine would be limited in its field of application to the marine and tractor fields, to which Mr. Ziesenheim replied that if the Diesel engine took over the marine, tractor and truck end of the automotive industry the fuel situation would be greatly relieved.

The discussion on the Ziesenheim paper had to be cut short on account of lack of time, and the next paper to be presented was that by G. P. Dorris on Eliminating Crankcase Dilution by Manifold Development, and is printed below.

Dorris on Manifold Development

About 1912 the gasoline began to carry heavy ends in such amount that the application of a hot-water jacket around carbureters and manifolds improved the operation of the internal-combustion engine. Then the heavy ends increased up to 1915 and 1916, when a further revision became necessary to provide still higher temperatures than were possible with the limit of 212 deg. supplied by the hot-water jacket. Exhaust-heated manifolds and hot-spots helped to maintain the same degree of efficient operation with the then increased heavy ends of fuel. About 1917 the heavy ends of the fuel sold as gasoline required such an amount of heat to vaporize them that the expression "crankcase dilution" appeared. Now the heavy ends of the gasoline have increased to a maximum boiling point of 446 deg. Fahr. This has made it necessary to go still further in the direction of the heat application to get satisfactory results.

Relative Heat-Absorption of Air and Fuel

In the development of the internal-combustion engine it has become evident that the application of heat to the fuel through hot air is only a mild method of heat application and very detrimental to the volumetric efficiency

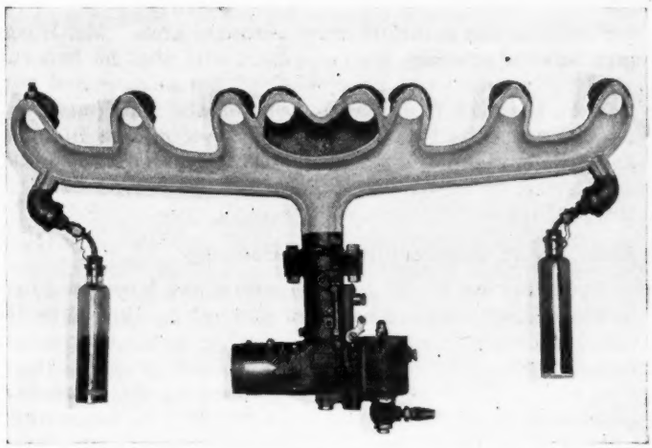


Fig. 1—Admission pipe of a six-cylinder engine in which the two exhaust ports at the center form a hot-spot immediately above the carbureter inlet

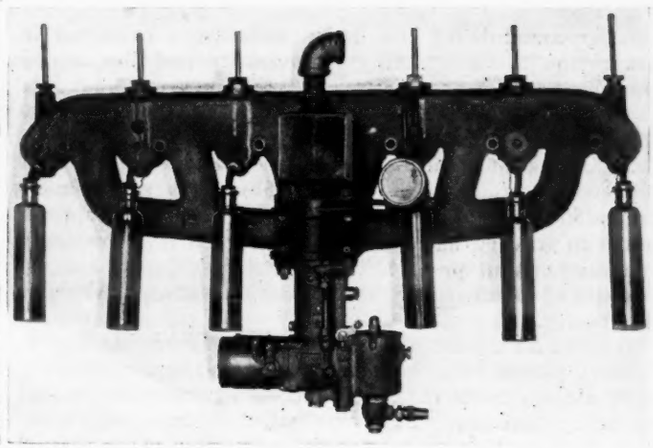


Fig. 2—An improved type of manifold in which the admission pipe is cast integrally over the exhaust pipe, thus securing better vaporizing of the heavy ends

and power output. It soon became recognized that the application of heat through the air was not a method of sufficient intensity to get desired results, and on further investigation it was seen that the direct application of heat to the fuel is a more efficient method as the relative heat-absorption capacity of air and fuel is approximately in proportion to their weights; hence the desirability of the elimination of hot-air jackets and the introduction of direct fuel-heating devices.

To the casual observer gasoline appears to be a definite fixed fuel not readily divided into several grades or degrees of combination of hydrogen and carbon. By subjecting this gasoline or fuel to a vacuum, it becomes evident that the vacuum readily separates the light ends from the heavy and gives a satisfactory gas with a cold engine, which is desirable in starting. Taking advantage of this fact, it is desirable to delay the delivery of the heavy ends of the gasoline until such time as the proper amount of heat can be applied to vaporize and pass them over to the cylinder in a readily mixed fuel for combustion.

Time Factor Required for Vaporizing

As the average motor car engine requires approximately 1/25 sec., at a car speed of 30 m.p.h. to vaporize, compress and expand one charge, it is plain that the time required to vaporize the heavy ends is considerably longer than that available at this rate of operation; therefore it becomes very desirable to provide for delayed passage of these heavy ends so as to supply sufficient heat for their thorough vaporization, to use them as a vaporous fuel and to prevent any liquid fuel, or heavy ends from entering the engine cylinders. The latter has caused disastrous results in crankcase oil dilution and premature wear in the engine bearings.

Fig. 1 represents an admission pipe of a six-cylinder engine, the two center ports of which being exhaust ports form a hot-spot immediately above the carbureter inlet, so that all heavy ends are thrown against the hot wall between the exhaust and admission pipes. The light ends are passed on to the cylinder as a vaporous fuel and the heavy ends vaporized against this hot-spot. This pipe was satisfactory using the fuel which was obtainable from 1917 to 1919. For experiment, the ends of the manifold were tapped for drains, whereby an inspection could be made of the process of delivery of the fuel to the cylinders. In starting the engine at a temperature of 32 deg. Fahr., 2 oz. of liquid fuel was collected in getting the engine warmed up to the operating temperature. The bottles would continue to fill slowly after the engine was warmed up. An inspection of the fuel in the bottles showed a 46-deg. Baumé gravity, while samples taken from the vacuum tank supplying the carbureter showed 68 deg. Baumé gravity. This test proved conclusively that the fuel yielded freely to an evaporation of the light ends, leaving the heavy ends to trail along the bottom of the admission pipe to the two end cylinders. From this it was obvious that a better utilization of fuel could be had under improved operating conditions.

Fig. 2 shows a revised manifold, wherein the admission pipe is cast integrally over the exhaust pipe, whereby considerable additional heat is applied and better vaporizing of the heavy ends accomplished. In making this pipe a pocket was provided between the two center exhausts, which is the lower pipe shown in the illustration, this pocket being an enlargement of the admission pipe and set below the point at which the fuel enters the admission pipe. This pocket collects considerable of the heavy ends on starting. The two center exhaust walls provided heat for vaporization after the engine was thoroughly heated up. Additional pockets were provided below the inlet ports, so that all heavy ends that might be projected over to the engine ports would be collected and their delivery delayed until such time as sufficient heat could be applied to vaporize them. To complete this experiment bottles were connected to these ports and

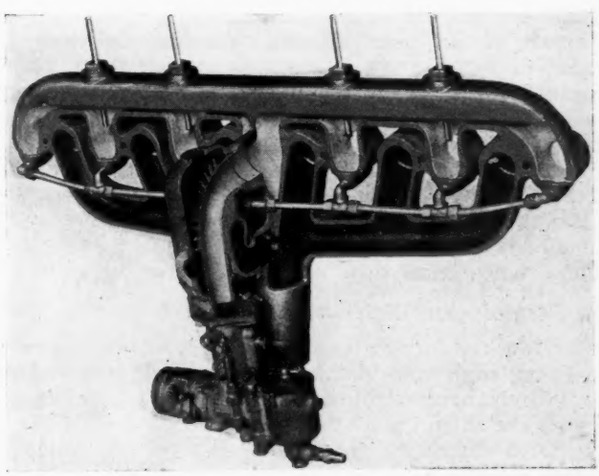


Fig. 3—View of the admission pipe as finally developed. One-half is removed to show the pipe employed to return the heavy fuel ends to the center vaporizing pocket

smaller amounts of the heavy ends were collected in proportion to the starting temperature and the use of the choker valve in starting. Blind tubes were set into the admission pipe down to the point of port-opening into the cylinder so that thermometers could be set into the pockets and the temperature of the gas at the point of admission to the cylinder noted. This temperature averaged 235 deg. Fahr., which permitted the engine to operate in a very satisfactory manner, with very clean combustion and practically no carbon deposit, but, on account of the decreased volumetric efficiency, the engine lost power.

A third admission pipe was made, as shown in Fig. 3, it being placed over the exhaust pipe and separated from it by air spaces so that the admission ports were heated by being cast adjacent to the exhaust ports, which secured a reduction in heat to the admission pipe. Fig. 3 illustrates this admission pipe with one-half removed and four of the thermometers in place. Six were used in the original experiment, but for production reasons the two end bosses have been eliminated. The thermometers show an average temperature, with the changed manifold, of 175 deg. Fahr.

By utilizing a vacuum a large portion of the light ends of the gasoline is vaporized, but the air is not heated or the admission pipe temperature raised unduly.

Figs. 2 and 3 show auxiliary heaters of different capacity bolted to the admission pipe. These heaters are controlled by valves, more or less hot gases passing from the exhaust to them. Fig. 3 shows the admission port pockets with the piping to return all heavy fuel ends collected to the central pocket or vaporizing still where they are stored until sufficient heat is accumulated to vaporize them.

With this type of manifold it has been possible to eliminate crankcase oil dilution completely and effect a reduction in carbonization. The lubrication efficiency has been improved. An improvement has been effected in acceleration and quick starting, and the engine will run at a constant speed with a good torque within 1 min. after starting. A 4000-lb. car has covered 17 miles on a gallon of gasoline in a straight run at 30 m.p.h. In a 1-gal. test, using kerosene as fuel, a car equipped with this manifold made 17.1 miles. These results prove the efficiency of the equipment in preventing the passage of liquid fuel to the engine cylinders.

A. W. Scarratt gave a description of a manifold which he developed for the trucks of the Minneapolis Steel and Machinery Co. This manifold was also referred to by Mr. Scarratt at last year's summer meeting and was illustrated in AUTOMOTIVE INDUSTRIES at that time. It was originally intended for gasoline but was found to give good results also with kerosene and has been used mainly with the latter fuel. On a 3½ ton truck a fuel economy of 6.8 to 7.1 miles per gallon is obtained. An interesting point is that the temperature at the outlet of the manifold is 175 deg. Fahr., with gasoline and 210 deg. with kerosene. The same manifold also works well with alcohol, although considerable heat must then be supplied to the inlet air.

One Remedy for Distribution Troubles

Mr. Mock, referring back to the paper of Mr. Ziesenheim on Diesel engines, said that within a few years we would be entirely over our present distribution troubles. He drew a sketch on the blackboard showing a baffle plate and expansion chamber acting as a fuel separator which was placed just beyond the Venturi tube of the carbureter. The liquid fuel particles separated out due to the low velocity in this chamber, drop onto a hot spot and are distilled off, thus rejoining the air stream. He predicted that when this device is fully developed there will be no need for limiting the manifold cross sectional area. Mr. Horning, referring to Mr. Dorris' paper, said that he had run an experiment in which he collected the unvaporized portion of the fuel from the bottom of the inlet manifold. At 400 r.p.m. he took off 50 per cent of all the fuel fed, and "the engine never knew it." This accumulation measured from 49 to 51 deg. Baume as against 58 deg. for the fuel itself.

Elements of Automobile Fuel Economy

The paper by W. S. James analyzes the power requirements of cars and traces these through to the source of supply, the energy in the fuel, showing where the various losses occur. The six appendices written by S. W. Sparrow, R. L. Wales and H. C. Dickinson of the Bureau of Standards cover the influence of air to fuel proportions upon power and efficiency, metering characteristics of several carbureters, mechanical efficiency of engines at various loads, ignition timing, the various theories of fuel knock and the relative merits of large, low speed and small, high speed engines. Both the paper and appendices will be printed in condensed form in early issues of AUTOMOTIVE INDUSTRIES.

In presenting his paper, James laid stress upon the need for atomization of fuel as an aid to vaporization, and pointed out that change in spark advance is more important with change in throttle position than with change in speed, so far as its effect upon economy is concerned. The character of the spark is also important, especially when combustion conditions are poor.

Little is known at the present time about the rate of energy liberation during combustion, said James, yet this is an extremely important factor.

James laid stress upon the importance, from a fuel conservation standpoint, of taking steps to secure better economy from the many million cars now in use, and suggested that car manufacturers might well advise present owners or assist them in making simple changes which would result in far better economy.

The time available for discussion of Mr. James' paper was so short that but few speakers could be heard.

Prof. Wilson described experiments he has been conducting at Massachusetts Institute of Technology for the purpose of determining the average dew point of commercial fuels such as gasoline and kerosene. This point is easily found in the case of fuels such as alcohol and benzol, which are not blended with other hydrocarbons, but has heretofore been difficult to measure in the case of complex fuels containing several hydrocarbons of various boiling points. The temperatures thus determined indicate that both gasoline and kerosene can be readily vaporized at temperatures well below that of the exhaust gas.

Mr. James stated that the results obtained by Prof. Wilson could be applied in determining the temperature of mixture entering the cylinder. A thermometer in the inlet pipe is usually welted with fuel, and is therefore supposed to record a temperature below that of the mixture.

W. G. Gernandt, who is interested in the development of high compression oil engines drew attention to the fact that many of the troubles caused by the difficulties in vaporization of even so good a fuel as gasoline are avoided in the injection type of engine which uses a much lower grade fuel.

Thomas Midgley, Jr., in discussing the use of indicators for measuring rapid rise of pressure, mentioned in the paper, drew attention to the fact that recent investigations have shown that certain lines of the spectrum change position with pressure change in the burning gas whose spectrum is being examined. This discovery suggests the possibility of using spectrum analysis as a means of determining the rate of pressure rise.

General Research Session

THE general research session, so called, was opened by Chairman H. M. Crane, who read by title only a paper on industrial research by L. A. Hawkins of the General Electric Co. This paper describes methods, facilities and results obtained in extensive research work conducted by the company with which the author is connected.

C. W. Stratford, well known to Society members and other engineers because of his long study of lubrication and lubricants from both the automotive and oil refiners' standpoint, presented a comprehensive outline of problems relating to lubrication which are in need of careful study and require much research work before solution can be anticipated. The following are among the many points of importance which were touched upon in the informal talk which he gave in lieu of a written paper.

The development of more comprehensive and satisfactory methods of determining the qualities of lubricants was mentioned as being a very real and pressing need, from both users' and producers' standpoints. Work in this direction is in progress at the Bureau of Standards (as recently described in these columns) and further work is needed. Lack of standard testing methods covering several known qualities of lubricants makes it difficult to draw intelligent specifications intended to secure uniformity in quality.

The fact that grease is a poor lubricant was emphasized. It is, the speaker stated, only a soapy sponge serving or intended to serve as a carrier for oil which gives it a certain lubricating value, without which it would be practically useless. The desirability of constructing transmissions, axles and other parts in such a way as to use oil instead of grease, and to retain the oil indefinitely was pointed out, and the considerable saving in power and fuel thus realized was mentioned.

The advantages and disadvantages of pressure feed and splash lubrication were touched upon briefly. Pressure feed systems are more positive and can be designed to assist materially in keeping bearings cool, but are inclined to result in somewhat higher oil consumption than splash systems, according to Stratford.

Graphite and soapstone are solids sometimes used for lubricants, but it is very generally agreed that oil is by far the best lubricant.

Lubrication of cylindrical bearings by oil is not facilitated by the use of oil grooves. An oil film once established in a cylindrical bearing without grooves is not difficult to maintain so long as the temperature is kept within reasonable bounds.

Decomposition and oxidation of hydrocarbon oils begin at about 200 deg. Fahr. The best operating temperature for oil depends upon many factors, but in general it is only slightly above atmosphere. Temperatures above 300 deg. Fahr. cause rapid oxidation.

Screens of fine mesh, intended to strain oil passing from bearings, are apt to become clogged and are not necessary if a sump allowing settling of foreign matter is provided and provision for drawing off sediment is made.

There is a wide variation in viscosity as between so called light oils, and the same is true for medium and heavy. Furthermore, there is seldom consistent uniformity in viscosity over considerable periods of time as between oils of the same brand.

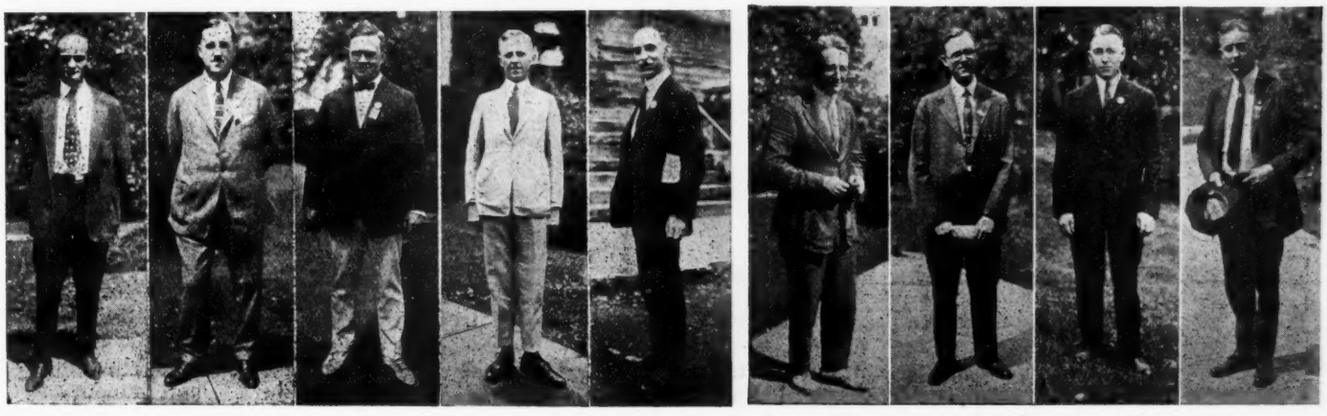
Tests of oils under a government or other unbiased authority with results of samples from various localities compared and published might aid in assuring uniformity.

Frequent change of lubricant tends to conserve the life of an engine. Oil drawn off should not be thrown away; 70 to 90 per cent of it can be recovered by blowing with steam after soda ash is added to break colloids, at a cost probably less than 5 cents per gal.

In opening the discussion on Stratford's paper, H. M. Crane said that the difference between splash, pressure and flooding lubrication should be emphasized. At exceedingly high speeds, splash cannot be depended upon for lubrication of the connecting rod bearings, because the centrifugal force is then so great that no oil from the outside can get to the rod bearings. At low speed, even a heavy duty engine can be effectively lubricated by splash. As regards the subject of strainers, a small screen of 70 mesh, which they had been using for a long time, was sufficient to remove a lot of sand (that always adhered to the aluminum castings) and other solid contaminating elements.

James N. Heald said that we have more cause to worry about the oil problem than the fuel problem. There is only comparatively little oil in a barrel of crude. A manufacturer of high-grade piston rings had told him that by the use of his rings he had been able to reduce the oil consumption of a certain car by about one-quarter. He claimed that much oil was being wasted. If we want to save oil, the best way to do it is to produce a first-

Among Those Who Read Papers



W. S. James | H. L. Horning | V. E. Clark | F. E. Ziesenheim | H. C. Dickinson | W. E. Lay | Herbert Chase | C. W. Stratford | G. P. Dorris

class cylinder bore. The high-grade manufacturers are doing this, but not the others. Boring and reaming, he said, do not produce a first-class job.

In reply to a question from Col. William G. Wall, Stratford said that there is little free carbon in a finished motor oil. He had never found more than 2 per cent free carbon in samples of crankcase oil, and where the carbon reached this proportion it was usually due to extra thin piston heads which heated to such a temperature as to cause the oil adhering to them to crack. Col. Wall wanted to know what caused the deposit inside the oil passages of the crankshaft, whether it was heat or the centrifugal force, and what the deposit consisted of. Stratford said that all contaminating elements were probably represented in this deposit and that centrifugal force was the cause of its formation in the oil channels.

William M. Britton said that vendors of asphaltic base oil state that the carbon deposit from this class of oil is of a soft nature and can therefore be removed easily, and the vendors of paraffin base oil tell one not to use asphalt base oil because it disintegrated so easily and gave no end of trouble in forming hard carbon. He wanted Stratford to tell him just what the facts were. In reply Stratford said that some acid-treated oils break up very readily at high temperatures, especially if they contain sulphur compounds. A good test of any lubricating oil is to heat a small sample of it to about 550 deg. Fahr. for 10 min. The carbon deposit is much the same whether the oil is of paraffin or asphalt base. When the oil is poured out of the cup in which it has been heated, the poor oil will always show a sediment, while the good oil will not. Much research still remains to be done before workable specifications for lubricating oil for any particular purpose can be written.

Chase Discusses Clutches

The third paper scheduled at this session was presented by Herbert Chase, the title being "Practice and Theory in Clutch Design." This paper will be printed probably in full in an early issue of AUTOMOTIVE INDUSTRIES. In opening the discussion, Chairman Crane said that our clutches are required to accomplish two very antagonistic things. Owing to the fact that the clutch must be released for brief moments in order to permit of shifting gears, it is necessary that the spinning weight of the driven element be as small as possible; while, on the other hand, the clutch must be sufficiently large to hold under the maximum load and also not wear excessively under normal slippage. It is the spinning weight problem that militates against the cone clutch, as the cone clutch, having only a single friction surface, must be of large diameter. One well-known foreign car that he knew of has a cone clutch that made it almost impossible to shift from a higher to a lower gear without what is known as double clutching; that is, disengaging the clutch and, after a slight interval, bringing it into engagement again for an instant. There is also much misunderstanding of the real function of the clutch brake. A clutch brake is of no service in changing from a higher to a lower gear, as in that case the clutch needs to be speeded up rather than retarded. Crane had a good word to say for the single plate clutch with lubricated asbestos lining. More than 100,000 miles of service of such a clutch had resulted in no appreciable wear.

Prof. Lay said that another pair of conflicting requirements was that in hard pulling you want the clutch to hold without slipping, while, when first engaging you want it to slip, but Crane thought this requirement could easily be met by suitable arrangement and handling of the control members.

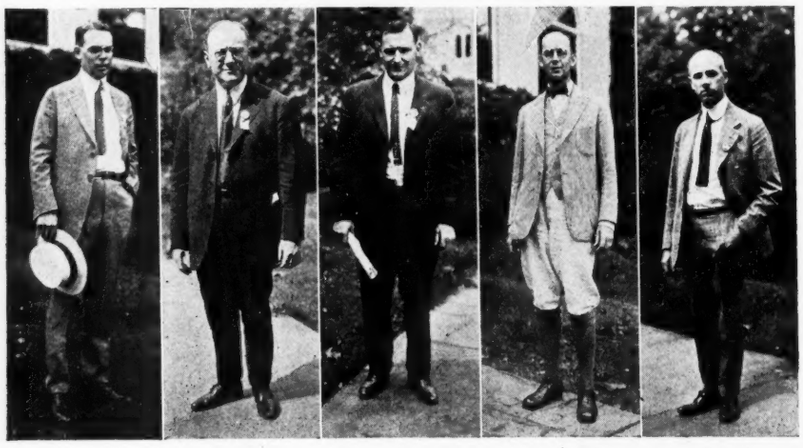
B. B. Bachman complimented Chase on the nature of his paper, saying that it represented an excellent type of research. He added that, in connection with the standards work, he had always insisted on the importance of gathering data from practice. One factor which was not covered in the paper, but is important, is the unit pressure on the splines. If this was obtained for the different clutches surprising differences would be discovered. Another item to which he called attention was the clutch pilot bearing. This bearing is located in an inaccessible place and is sometimes hard to lubricate, and for this reason the use of a ball bearing at this point is, he said, beset with difficulties.

F. E. Moscovics called attention to the coil type of clutch used on the early Mercedes cars. These clutches, he said, were exceedingly compact, yet held firmly when under load, and also slipped well when handled carefully. Crane said his firm repaired a Mercedes 1906 car and in that way gained some experience with that type of clutch. Owing to the small inertia of the driven part the gears shifted very readily—it almost felt as though there was nothing removed by the shifting lever. The clutch had to be handled carefully, however, as otherwise it was likely to grab. Another defect was that if the clutch was allowed to slip for any length of time the wear was very rapid. Other members, including Messrs. Sperry and McGeorge, attested to the excellent qualities and extensive use of this type in various lines of industry.

In closing the discussion Chase said that he believes the need for low spinning weight emphasized by Crane is best realized by the multiple disc design, since sufficient capacity can be had without using friction faces of large diameter or weight.

While acquainted with the Mercedes type of clutch the author said he had omitted reference to it for the same reason that reference to other types not now extensively used had been omitted—namely, that he preferred to confine the discussion to widely-used commercial types.

Prof. W. E. Lay of the University of Michigan presented the concluding paper. It was entitled "Co-operation in Research." He contrasted industrial and technical school research and defined the field for each. The major portion of the paper was devoted to a description of the new testing laboratory of the University of Michigan, which is specially well equipped to make engine and chassis tests as well as tests of a metallurgical character.



W. G. Wall | F. M. Germane | A. D. T. Libby | R. E. Huff | J. E. Hale

The Aeronautic Session

At the aeronautic session held on Wednesday morning J. G. Vincent occupied the chair. Three papers were presented, one of a somewhat technical and the other two of a commercial or economic character, as follows: Aviation Powerplant Development, by G. C. Mead and L. E. Pierce; Air Transportation and the Business Man, by Col. V. E. Clark, and Need for Federal Control in Commercial Aviation, by S. H. Philbin. Following is an abstract of the paper by Messrs. Mead and Pierce.

Aviation Power Plant Development

Aeronautical engineers unconsciously consider that an engine must weigh less than 2 lb. per hp., and that the fuel consumption is satisfactory if it is in the neighborhood of 0.50 lb. per h.p.-hr. Such an engine rarely lasts more than 50 hr. without a top overhaul, which is equivalent to 6000 miles of air travel. The airplane designer is inclined to believe he must have maximum power and minimum weight at any cost. In this case, the cost is the reduced life of the engine. The commercial requirements involve the use of entirely new factors, since the prime requisites of commercial work are efficiency and durability, which changes the engine design considerably. Our definition of durability is long life. All aeronautical engines must be reliable, but in the past durability has been sacrificed for light weight per horsepower. The weight factor for engines with these requirements becomes at least 3½ lb. per hp. Commercial engines should run at least 16,000 miles without a top overhaul, with a fuel consumption approaching 0.40 lb. per hp.-hr. These constants contrast sharply with those for the military requirements. In this connection it is interesting to compare these figures with those for the Wrights' first engine, which weighed approximately 7.6 lb. per hp. This is a decided indication of the progress that has been made.

The power available from a single cylinder depends upon the dimensions of the cylinder, the speed of operation and the compression ratio. Taking up the cylinder dimensions first, we find that a 5½-in. bore cylinder was practically the limit at the close of the war, which made available some 45 hp. per cylinder and resulted in a large number of cylinders where considerable power was required. The limiting factor for the bore appears to be the reciprocating parts. With large bores, the pistons become difficult to cool in the usual manner. This is not an insurmountable obstacle, since several expedients are known for cooling pistons in other ways. The principal reason is that the power required to overcome the inertia of the reciprocating parts increases rapidly with the increase in the cylinder bore at a given speed. Indicated mean effective pressure is independent of cylinder size, at least so far as our experience to date goes. Therefore, as the cylinder bore increases, the reciprocating weights increase and the speed of the crankshaft must be decreased to permit of a good brake mean effective pressure. At present, cylinders of 7-in. bore are being operated successfully at speeds as high as 1400 r.p.m., with brake mean effective pressures corresponding to those obtained with any of the smaller cylinders. Powers as high as 65 hp. are now obtainable from a single cylinder of this size, a gain of 30 per cent.

Taking up the question of stroke, it has been found that a "square" engine, one having the bore equal to the stroke, makes the lightest possible construction. When the valves are placed in the head, it is very difficult with long strokes to secure sufficient valve area, and still cool them properly so that they will stand up under the temperatures resulting from the high mean effective pressures.

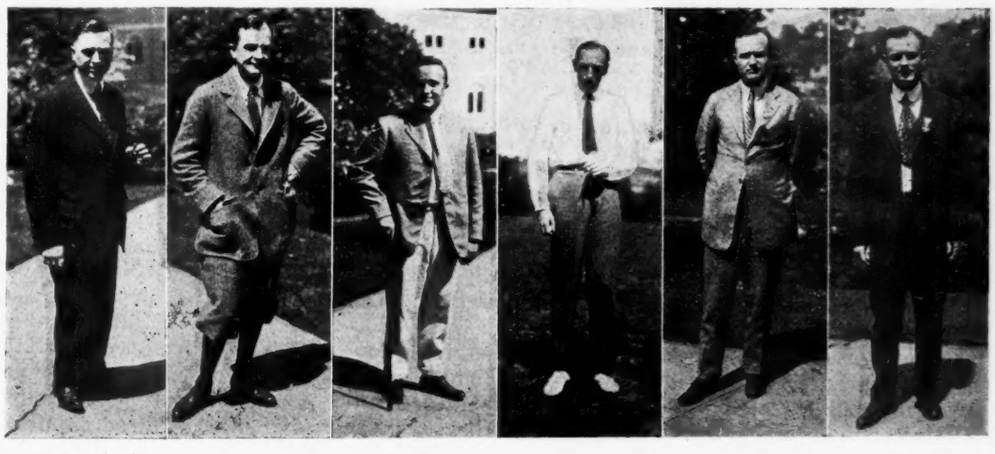
The speed of the engine, or its rate of doing work, is quite important. The limiting factor here becomes the propeller speed. With the pursuit ships it is possible to run the propeller up to 2100 r.p.m., but for commercial work, due to lower flying speeds, it is not desirable to turn the propeller nearly so fast, because of the effect on propeller efficiency. A propeller speed of 1800 to 2000 r.p.m. is considered more or less standard for military work, and from 1000 to 1400 r.p.m. for commercial work. In the case of a dirigible, the propellers turn about 550 r.p.m. The question immediately arises, Why not gear the engine? For military work, no commercially manufacturable gearing has been devised which permits a reasonable powerplant weight per horsepower.

It has been found desirable to increase the compression-ratios as much as possible, to permit the maximum power output of the engines at great altitudes. The maximum compression-ratio from which a gain in power can be secured is 7 to 1. So far, the size of the cylinder does not seem to limit the use of such a compression. Above 5¼ to 1 it is desirable to use some anti-knock substance such as benzol, if it is necessary to operate the engine on the ground under full power.

M. E. P. Possible With and Without Dope

Without dope, it is possible to secure 130 lb. per sq. in. mean effective pressure in water-cooled cylinders, and with dope as high as 145 lb. per sq. in. it follows that we shall be able to produce much larger powerplants with fewer cylinders than formerly, if a demand for them arises.

Great strides are being made in the development of air-cooled cylinders for aviation work. The British report be-



Alex. Taub | Al. Poole | E. B. Ross | J. W. Watson | Thomas Midgley, Jr. | O. C. Berry

ing able to obtain as high mean effective pressures as with water-cooled cylinders. So far, the maximum mean effective pressure which has been developed in this country with large air-cooled cylinders is in the neighborhood of 110 lb. per sq. in. With relatively small cylinders, pressures as high as 125 lb. per sq. in. have been secured. Thus far satisfactory air-cooling has been limited to radial engines. Air-cooling has advantages for an airplane, due to the tremendous differences in temperature under which the engines are forced to operate. It also makes the engine somewhat less vulnerable when used for military purposes. This does not seem to be a very important feature, since most planes that are shot down apparently fall because of fire rather than any other cause. The disadvantages of this type of cooling are that it allows, so far, relatively low mean effective pressures, increases the parasite resistance of the airplane considerably, and does not permit easy temperature-control.

Four cylinders in line are not satisfactory, due to both the power limitations and the vibration. Six cylinders form an ideal combination, since it is possible to obtain powers as high as 400 hp. from this number, and the engines are perfectly balanced mechanically. The weight factor for a six-cylinder engine is from 2.5 to 3.5 lb. per hp., depending upon the service. The limit of the number of cylinders that can be put satisfactorily in one line is eight, due to the torsional vibrations of the crankshaft. The weight of such an engine is about 20 per cent greater per horsepower than for a six-cylinder engine, due to the long crankshaft and crankcase, but for such uses as dirigible work the durability and efficiency of this type are sure to recommend it. Over 500 hp. is available in a single unit of this type.

The V-type eight-cylinder engine is undoubtedly the lightest water-cooled engine known, for the reason that it has the shortest crankshaft for a given power. Weight factors of 1.45 lb. per hp. have been secured from this type of engine.

It has already been proved that eight cylinders of sufficient power to give 400 hp. at 2000 r.p.m., which is a pursuit propeller-speed, do not involve reciprocating parts of sufficient weight to make the vibration serious to the plane structure.

V-type 12-cylinder engines are used considerably for short-distance bombing airplanes, where the engine weight is a factor. Small engines of this type will undoubtedly be in demand for pleasure purposes, just as they are in automobile work. The best weight-factor from a 12-cylinder engine is in the neighborhood of 1.9 lb. per hp. With a given displacement the 12-cylinder engine presents much more exposed cylinder and port area to the cooling water and therefore a considerably larger radiator is required than for a fewer number of cylinders. This increases the total weight of the powerplant and also its head-resistance.

Radial Engines

Serious consideration has been given to radial engines, particularly by the British. The weight-factor for this type of engine is about 2 lb. per hp., when the design is such as to permit the engine to operate satisfactorily for 50 hr. This is practically the same weight-factor as for the V-type eight-cylinder water-cooled engine complete with water and radiator, so that there is really no saving in weight. Moreover, a radial engine of a similar power to that of the V-type eight-cylinder engine has an enormously increased parasite resistance. Radial engines properly balanced are very smooth-running and compact as regards the concentration of weight. The temperature control is very difficult. Fuel consumptions similar to those obtained with water-cooled engines are now possible, but the oil consumptions are just about twice those for the standard water-cooled types. Water-cooled radial engines have been built, such as the Salmson, made in France, but there does not seem to be any particular value in such designs.

In a summary the authors made the following statements: We have not reached the limiting size for any type of engine as regards the maximum power available. No increase in engine performance can be expected unless new materials of construction, new fuels or new cycles of operation are made available. Continued development will refine the practices of the art and result in bettering the life of the engine and the service it renders, rather than its performance. Therefore, increased airplane performance must be secured mainly by improvement in airplane design. Great advance seems to be possible in this direction. One reason for the tremendous powerplants available for airplanes has been the effort to secure performance by brute strength. Absurdities can soon be reached if this trend of development continues. It is certainly worthwhile to consider what can be done with a reasonable-sized power-unit, by altering the design of the airplane. As shown in the last Pulitzer Trophy Race, excessive horsepower is not necessary to secure high speeds. The next few years should see a reduction in the power demanded of pursuit engines.

More Miles Per Gal. of Fuel Desirable

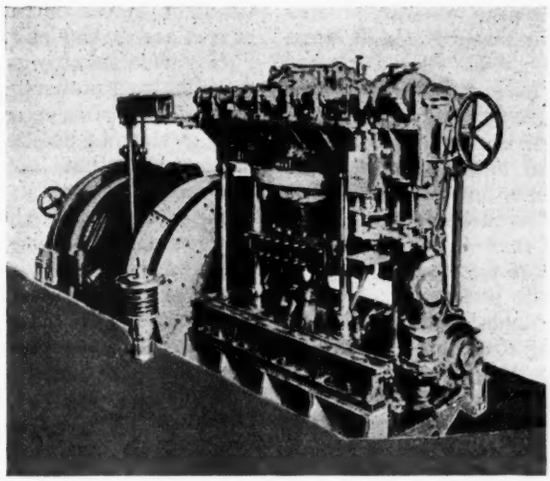
It is high time that attention be given to a most important problem, the fuel mileage obainable from a given airplane. It is unquestionably true that the average person could not afford to operate some airplanes, even though he might be able to purchase one, because of the poor mileage secured from a gallon of fuel. This is an essential consideration for commercial work, due to its effect on the profits of an operating company, and should be given study by the military authorities also, on account of the effect it has upon the quantities of fuel required in case of hostilities. This is, to our minds, the best and most obvious reason why the power requirements for aeronautical powerplants should be reduced rather than increased. It is not commercially possible to build so many power units within a given range. Airplane designers must be satisfied with fewer units, if we are to commercialize the business.

It is believed that the effect of engine dimensions on maneuverability is largely overestimated. The reason that popular comment is so often to the effect that the engine is the most important factor is the fact that there is no ready means by which the aerodynamic qualities of the airplane affecting maneuverability can be thoroughly analyzed and visualized. For similar horsepowers engine type rather than overall size will have the greatest effect on the parasite drag of the fuselage group. The efficiency of the cooling-element design for water-cooled engines is considerably better than that for air-cooled engines. Between practical limits, the effects on the performance of the airplane of variations in the values of engine weight per horsepower, of cooling efficiency, of fuel economy and of altitude performance of the engine are very pronounced. The demands of super-performance in military designs and greatest operating efficiency in commercial designs will require the development of engine types which are most favorable in these respects. The relative importance of the factors involved is governed by the particular service for which the airplane is designed.

Problems of powerplant installation are centered about the need of a close co-operation between the builders of airplanes and engines. The requirements of each system of installation can be met only be acquiring a correct knowledge of what these requirements are and satisfying them fully. A study of the engine mounting in complete detail, developing the truss system to accommodate all of the en-

gine forces involved, both static and dynamic, is a most important requirement in insuring a successful installation. Simplicity and practicality of design and the suitability of the accessory equipment used are most essential in the development of the several powerplant systems. The development of the complete powerplant installation must be made with a view to permitting the greatest possible degree of service accessibility. Only in such a way can the proper mechanical attention be assured for the powerplant. The fact must not be lost sight of that the industry is in a formative period and for this reason we must expect to spend a tremendous amount of time and money in research. We cannot standardize without the necessary knowledge, and we cannot obtain that knowledge without research.

After the presentation of the above paper, Elmer Sperry gave as a volunteer paper an outline of some development work he has been doing in the line of compound Diesel engines for automotive purposes. Just why this was inserted in the aeronautic session was not explained. Sperry referred to the fire risks connected with our present airplanes and cited accidents in the air mail service in support of his statement. He said that in his type of Diesel engine he used what he called bunker oil which actually had fire extinguishing properties. He had recently read of the use of magnesium in commercial work and obtained some samples of the metal. He expected that there was something wrong with the metal and found this to be the case, in that the chips produced in working it were apt to catch fire. Squirting water on the metal would only make matters worse, and to reduce the fire danger, in the factory in Frankfort, Germany, where they produced this metal, they supplied each of the workmen with a pail of the same grade of heavy oil which he used for engine fuel. The pail of oil hung close to the lathes and the oil was for use in smothering an outbreak of flames.



The Supercharged Compound Diesel Type Engine, Described by Sperry.

Sperry showed on the screen photographs, drawings and indicator cards of a three-cylinder compound expansion engine with two 7 by 11 inch high pressure cylinders. The low pressure cylinder is located between the two high pressure cylinders and receives the discharge from these two cylinders alternately. The lower end of the low pressure cylinder is used as a precompressor and forces into the high pressure cylinders a much greater amount of charge than could be gotten in by suction. Owing to this precompression and the resulting supercharging the compression space is not nearly so flat as in the ordinary Diesel engine, and the proportion of surface or cooling area to volume of compression space is therefore much smaller. As in the regular Diesel cycle, nothing but air is drawn into the precompressor and transferred to the compression chamber of the high pressure cylinder. When the piston in the latter reaches the top of the stroke, fuel is injected by a solid injection mechanism in the center of the cylinder head and the mixture ignites spontaneously owing to the heat of compression. The explosion pressures normally attained are in the neighborhood of 900 lbs., per sq. in. These are pressures usually associated with detonation, and Sperry claims to have solved the problem of harnessing the detonation and turning it to useful account.

In the high pressure cylinders the charge is expanded down to about 300 lbs. per sq. in., and it is then transferred to the low pressure cylinder. The two high pressure cylinders are set to explode alternately at equal intervals, working on cranks in the same plane. Using the high pressure cylinders only, Sperry stated, he obtained only 29 hp., while with the low pressure cylinder operating in addition the output was increased to 200 hp. In reply to a question by Dr. Miller as to whether any trouble was experienced from sulphur in the fuel, Mr. Sperry said that it was necessary to keep the exhaust temperature above the temperature of water condensation. Mean effective pressures of from 62 to 75 lb. per sq. in. are obtained.

A number of indicator cards from the engine, obtained with an ordinary piston type of indicator, were thrown on the screen, and emphasis was laid on the fact that the combustion line was absolutely vertical, showing that the combustion took place very rapidly. It is thus shown that one of the objections often raised against the use of the Diesel engine in automotive practice, that the charge won't burn sufficiently rapidly, is not well founded. In the low pressure cylinder the exhaust is through a port at the lower end, which is closed some time after the piston has started on its upstroke, and the gas remaining in the cylinder is then compressed until at the end of the stroke the pressure is substantially equal to the transfer pressure of 300 lb. per sq. in., thus forming a cushion for the low pressure piston and also tending to reduce losses due to clearance in the low pressure cylinder.

Sperry had thrown on the screen a sectional and an outside view of a so-called Diesel aircraft engine built by Dr. Junkers in Germany (views already shown in AUTOMOTIVE INDUSTRIES) and remarked that there were shown two spark plugs in the cylinder wall, which proved that it was not a real Diesel engine. The compression pressure used was only about 250 lb. per sq. in. and there was, moreover, the complication of the double crankshaft. In reply to questions during the discussion Mr. Sperry said that the fuel consumption amounted to 0.42 lb. per hp.-hr. and that the maximum speed attained was 2400 r.p.m.

The engine which Sperry has built and on which the indicator tests were made was of the marine type and weighed about 27 lb. p. hp. He has now agreed with the Government to build a light engine of similar design which is not to exceed 5 lb. per hp., and he hopes to improve upon this figure.

A. D. T. Libby asked what had been the experience with regard to the increase in power by the use of two or more spark plugs in such large cylinders as discussed in the papers.

J. G. Vincent replied that he had had experience with a four valve dirigible engine of 6⅝ in. bore and 7½ in. stroke, a type of engine in which fuel economy was very important. The engine had four spark plugs per cylinder. With all four plugs in good condition the engine would run without appreciable knock, although it was impossible to go beyond a compression ratio of 5 to 1, which was ascribed to a slight variation in the distribution. If three of the plugs were cut out the engine would go nearly through the roof, and it ran about as badly on

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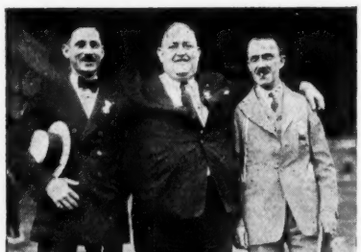


Mark Smith, Bert Kelly, Lon R. Smith.

three as on two plugs. This engine operated constantly at 1400 r.p.m.

A member asked why it was that no more progress had been made in this country in the line of water-cooled radial engines which seemed to have reached a high stage of development abroad. To this L. E. Pierce replied that his company (Wright Aeronautical Corp.) is now working on the air-cooled engine problem, and after that had been solved they would take up the water cooled engine. Vincent said that air-cooled engines were made radial because of cooling requirements and not because of aircraft requirements. He also referred to Sperry's mention of the fire hazard and averred that it was not nearly so great as made out by Sperry. The pilots, as a rule, do not dread fire nearly as much as the possibility of being obliged to land in rough, restricted fields. He himself had no more fear of an airplane catching fire than of the same thing happening to an automobile. Engineers now knew how to build airplanes so as to make them practically fireproof; that is, even if a leak should develop in the fuel system the fuel would not accumulate in any place where there was a chance of igniting it. It was true that there had been some cases of fire on the planes of the air mail service, but this was due to the fact that the Post Office, owing to lack of sufficient funds, was compelled to make use of obsolete equipment.

John McGeorge pointed out that while at McCook Field the previous week he observed that the fuel joints on some of the engines there were poorly made, and that this might be one of the explanations of the occasional burning up of planes. It was not a matter of poor design but merely of poor workmanship. Vincent said it had to be remembered that at the Field they got engines for test from all over and that some of these naturally were somewhat crudely built. But before they were put into planes they were always given extended block tests.

Mr. Caldwell said that what we wished to commercialize was not so much the art of flying as the aircraft industry. If it were possible to develop a good pleasure airplane it should not be difficult to find an extensive market for it. He referred to the possibilities of the helicopter, which does not require a big field to start from and land in, can rise to a considerable altitude in a few minutes and is much less unwieldly than a plane. The French were doing development work on helicopters, but had not to date achieved any very notable results. Col. Clark, the author of one of the papers of the morning, later said that he did not think highly of the possibilities of the helicopter. Its stability must of necessity be rather uncertain, not much speed in a horizontal direction could be expected, and there would always be a considerable element of danger if the engine should stop accidentally while the helicopter is in flight.

In Col. Clark's paper the possibilities of getting capital to seek investment in aeronautic enterprises were discussed and it was shown that the prospects were not very rosy. This point was taken up by Fred Moscovics, who said that capitalists should be appealed to to help the movement along on patriotic grounds without any particular view to profits. It had been the fact throughout history that those nations which had the most advanced system of transportation also led in culture and in civilization. He had spent the winter on the Pacific Coast, where there was more flying than in any other part of the country, and he gave some figures as to the time that could be saved by the use of airplanes over different routes. Seattle and San Francisco are 800 miles apart and the trip by railroad takes more than a day. The aerial distance is much shorter than the distance by train and the air trip can be made in about 8 hours. Vincent agreed that commercial aviation had the best chance where other means of transportation are comparatively poor.

A representative of the Air Service stated that they had recently developed a method of predetermining the static thrust of a propeller of given dimensions; that is, the thrust exerted by the propeller when the airplane is at rest and the propeller is being revolved at any given speed. It was found that there is a certain relation between the thickness of the blade and the thrust. The newly discovered method permitted of calculating in advance the horse power which a propeller will absorb at different speeds. The usual ratio between thrust and horse power was 7. The thrust varied as the square of the revolutions per minute, and by increasing the diameter of the propeller and at the same time reducing the speed of revolution to keep the strain due to centrifugal force constant, the thrust ratio could be increased to 10.5 to 1. He was of the opinion that eventually the propeller would be used in landing. In traveling over the country he had observed large districts where it would seem almost impossible to construct landing fields for airplanes, and yet birds landed there every day. When a bird lands it first comes down at considerable speed and then, just before touching the ground it flaps its wings, that is, it exerts considerable power, which enables it to land in a comparatively restricted space.

Col. Clark, referring to a statement by a previous speaker, that one of the ways of getting cities to provide landing fields was to give them an air mail service, said that he was not sure that such an inducement would have much effect. Salt Lake City, for instance, voted an ap-

(*Continued on page* 1161)

The Combustion Session

(*Continued from page* 1147)

the flame must propagate itself is greatly decreased, hence detonation velocities are not reached.

Replying to the remarks on the advantages of the Knight engine from the turbulence standpoint, he stated that he agreed in this and that there is apparently but one disadvantage to the Knight engine, and that is the location of the spark plug in the pole of revolution of the stream of turbulence and up in a chamber out of the way. The turbulence is so good, he said, in these engines that notwithstanding the low m.e.p. the fuel economy is good. The reason for this is that the turbulence makes up for the loss of compression, and in a measure acts as its equivalent.

C. A. French in presenting his paper on flame, printed in last week's issue of AUTOMOTIVE INDUSTRIES, advanced several interesting theories, some of which were accepted as a step in the development of present knowledge on this subject and others which were questioned by the members. It will be recalled that the author reached the conclusions that to burn heavy fuels with a blue flame it is desirable to 1. Thoroughly vaporize fuel. 2. Retard speed of oxidation. 3. Crack opaque vapors before ignition by use of radiant heat. 4. Raise compression and use reasonable excess of air. 5. Ionization to prevent ignition. 6. Induce great turbulence. 7. Destroy reverberatory action of combustion chamber walls. 8. Eliminate pockets in the combustion chamber. 9. Locate spark plug in exact center of combustion chamber.

A written discussion by O. B. Zimmerman made the point that we must correct our fundamental theories on what actually occurs in the combustion chamber if we are going to perfect our engines. French's paper, he said, helps us to visualize flame propagation and to realize the effects of changes in the mixture, shape of the container, etc. It will also help to bring home the point to refiners regarding the need of a more uniform liquid fuel.

He stated that we are not far short of the time when the molecular structure of the fuel can be commercially rearranged to provide us with a better fuel. Brewer added that combustion should be so rapid that it should be complete before the piston has traveled 1/10 of its stroke.

Prof. Wilson disagreed with French in his ideas of the molecular and atomic structure of the fuel and showed by models what is generally recognized as the structural form making up the molecule of fuel. Such a conception, he stated, is as necessary a fundamental to the chemist as a true working drawing is to the engineer. He stated that all atoms do not occupy the same space as French contends, but may vary in size in the proportion of 1 to 32. From past research it is known that molecules are tied together in different ways and have different structures. He showed by means of models the construction of hexane, and the benzine ring. With the straight chain construction he stated that the hydrogen burns first and the carbon on the free ends only after hydrogen is combined.

In the absence of Sir Dugald Clerk, his paper entitled Cylinder Actions in Gas and Gasoline Engines was presented in digest form by Prof. Daniel Roesch. Brewer reviewed at length the work done by Sir Dugald. He stated that in 1906 there was a marked revival in research work on internal combustion engines. The complete theory of the thermo-dynamics of internal combustion engines was largely developed in the few years around that time. Brewer stated that the United States has now outstripped Europe in automobile engine research. No discussion was given of Sir Dugald's paper. As Chairman Midgley laughingly put it, "No one felt capable of going up against Sir Dugald on these matters."

Highway Transport Session

IN the absence of H. W. Alden, the highway session was presided over by President David Beecroft. The important work of the highway engineer in developing better and more enduring roads was discussed in papers by A. T. Goldbeck of the United States Bureau of Roads, and C. J. Tilden, engineer of the Highway and Highway Transport Educational Committee, the latter paper being read by Albert Reeves of the National Automobile Chamber of Commerce. The large attendance at the meeting indicated the interest of the engineers in this subject.

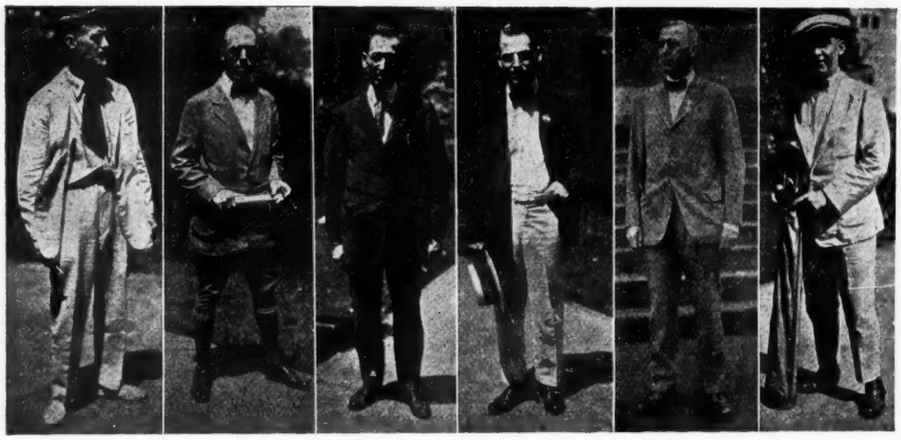
A. T. Goldbeck made the point in his paper that the ultimate consumer does not care who gets the money or how the results are accomplished as long as his transportation bill is as low as it is possible to make it. He stated that the cost of road construction and maintenance must be reduced, and his remark that there is something wrong "when roads disintegrate in two and sometimes in one year" was heartily agreed with by the engineers present.

The author made clear the point that the best highway is the one which carries the greatest amount of traffic for the least amount of money. Another point which he emphasized and dwelt upon as the main issue is that the highway and the vehicle should be mutually suited to each other. He stated that weights and speeds of vehicles are now limited because vehicle construction and road construction are not balanced to meet the requirements of one another.

Goldbeck stated that in his opinion the truck should be designed to meet the limitations of road construction in the same way that the railroad engine is designed to meet the load limitations placed on railroad track. In order to reduce the unit load on the roadbed and on the track the railroad engine has more than four wheels. In the same way the possibilities of a greater number than four wheels should be considered by the truck engineers as a real step in the way of highway conservation. Goldbeck stated that he did not wish to go on record as actually favoring the multiple-wheel vehicle, but that he did consider that the merits of this type of construction should be given very careful consideration, taking the angle of road life as one of the dominant factors.

In speaking of the actual construction of the road, the author stated that the subsoil formation is of the highest importance, as the load is really transferred to this, and when the load exceeds the capacity of the sub-base the road is sure to disintegrate, because this permits the surface to break up.

Another factor in the situation is that of tires. Goldbeck stated that as far as the sub-base for the road is concerned there is little or no difference in the solid or pneumatic tire, as the loading of the road per square inch of ground contact is about the same. In other words, relatively there is an extremely high unit load transmitted to the sub-surface, regardless whether the truck is pneumatic or solid tired, and there is a strong possibility that the multiple-wheeled vehicle will provide sufficiently decreased unit load to give a marked difference in road life.



H. C. Gibson | C. T. Myers | R. E. Northway | H. C. Buffington | E. L. Apperson | E. L. ("Casey") Jones

N. C. Cramer, Albert Champion, E. O. Christiansen

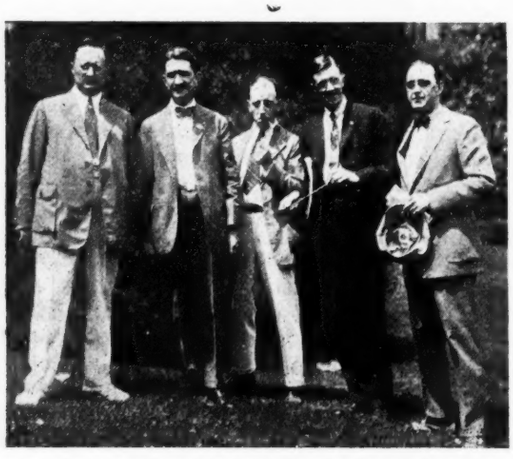
Goldbeck stated that he hoped that the engineers would co-operate with the government department in working out the problem of what is the best road and what is the best way to design a vehicle, so that combined cost of road and vehicle would result in the least possible expense to the consumer.

Russell Hoopes, in the discussion, asked what had been found to be the effect of high and low unsprung weights. In answering this the author stated that there is a slightly noticeable difference in road wear in favor of low unsprung weight, but that as far as the actual vehicle produced is concerned the difference is so slight as to be unimportant. B. B. Bachman brought up the point that trucks as now designed are for the purpose of meeting road conditions as they now exist. Better roads, he stated, would undoubtedly have a material effect on the design of trucks were these roads to be sufficiently universal to represent average conditions. The object of the truck as well as the road is moving merchandise at the lowest possible cost. In this, Bachman pointed out, the road is a considerable factor, as has been shown by tests over the roads. He stated that fuel consumption on one particular run showed a noticeable difference in the miles per gallon fuel consumption of the trip in traversing different highways. In other words, the question of getting the greatest amount of mileage per gallon per ton of product carried must be considered from the road standpoint as well as that of the truck.

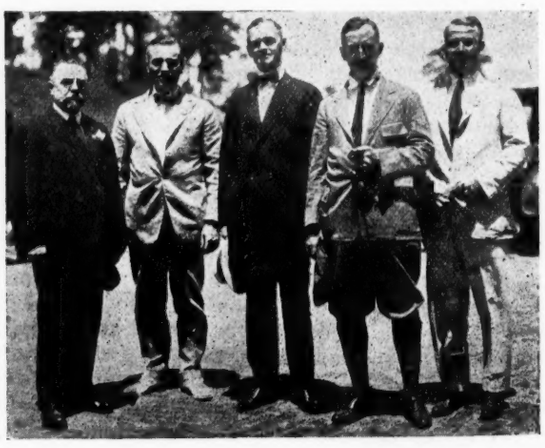
R. E. Wilson asked if the pneumatic tire did not help reduce impact on the subsoil. To this the author replied that there was no difference of importance noticeable in their observations, but that unit loads are too high on the big capacity trucks, and it is for this reason that he is looking for more careful examination and possibly for some important developments in the line of trucks with more than two driving wheels.

F. E. Moscovics stated that the suggestions of Goldbeck should be followed, and that the engineers who are members of the S. A. E. should make it their business to co-operate with government road officials to so design their trucks that the life of the road and the cost of transportation will be a minimum. At the request of President Beecroft, Moscovics put his suggestion in the form of a motion to the effect that it was the sense of the meeting that the members of the Society should co-operate with the government highway officials with a view to getting together on the design of both trucks and roads to the end that the highest possible transportation efficiency may be realized. This motion was passed unanimously, and a working committee will be appointed. In closing the discussion Goldbeck expressed his appreciation of the action taken by the Society in designating its intention of naming this committee.

"Transport Engineering Education" was the title of a paper by C. J. Tilden. In this, the necessity for educating, through our universities, men capable of intelligently spending the hundreds of millions appropriated for road construction was pointed out. Before reading the paper Reeves stated that the automobile business has two menaces to-day—unfair legislation and poor roads. He said there are 2,500,000 miles of road in the country, only 10 per cent of which are improved.



W. B. McCarthy, H. A. Brown, H. C. Rice, A. L. Clayden, O. J. Rhode.



G. L. Lavery, W. J. Bryan, J. G. Swain, C. C. Carlton, A. S. Van Halteren.

Standardization Session

THE Standards Committee session was the first of the meeting and the attendance was surprisingly good and those present stayed well until the finish. Under the direction of B. B. Bachman, chairman of the Standards Committee, the program was conducted with dispatch and the comment kept to the subjects in hand. Chairman Bachman also showed a grasp of the parliamentary difficulties that might involve the procedure and kept things moving by avoiding any pitfalls that might be hidden in the motions, rather than by untangling them later. His run of good-humored comment kept the audience interested despite the severe heat in the ball room of the hotel, which served as the meetings place.

The report of the Standards Committee, the bulk of which was published in AUTOMOTIVE INDUSTRIES for May 19, was adopted, except in certain particulars mentioned below, in the form presented. This report, in the amended form, was later approved by the Council of the Society. It will now be submitted to voting members of the Society in a letter ballot, and if favorably acted upon will become standard or recommended S. A. E. practice.

The entire truck division report incorporating recommended practice for body installation dimensions and motor truck front hubs, was unanimously adopted without discussion. This report, looked upon as the most important of the entire standards work of the year, was reserved until last. When complete silence greeted the call for discussion and a hearty unanimous aye, answered the request for a vote, the members present broke into applause. Considerable interest is being displayed in the next step along the line of recommendations for preferred practice in front hubs for passenger cars.

Clutch Release Type Thrust Ball Bearings

W. R. Strickland read the report of the Ball and Roller Bearings Division, which covered recommended practice regarding clutch release type thrust ball bearings. The dimensions standardized are the bore, width and ball diameter, the outside diameter being left open, owing to divergence in present practice and to the fact that standardization of this dimension is not very important. All the dimensions are given in inches, which is in accordance with the practice of the makers of 80 per cent of the clutch release type bearings now manufactured. The report was adopted as presented.

Roller Chains

W. F. Cole read the report of the Chain Division. This covered two items, viz., a new system of numbering for chains of different pitch, roller diameter and width, and a standard form of roller chain sprocket tooth. This section of the report was adopted as read. There was considerable discussion on the proposed new sprocket tooth form. M. C. Horine objected that the new sprocket form was still in the experimental stage, and that it should not be given the dignity of an S. A. E. standard until it had been thoroughly tried out in practice.

H. S. Pierce of the Link-Belt Co. replied that his company had used a form of sprocket tooth very closely approximating that recommended since 1908, and had found it very satisfactory. The tooth form, therefore, was not experimental. W. F. Cole of the Baldwin Chain & Mfg. Co. said that his firm had cut sprockets in substantial accordance with the form recommended, and trucks fitted with such sprockets had been run for many thousands of miles. Horine remarked that the largest manufacturer of chain-driven trucks had had no opportunity of discussing the merits of this form of sprocket, and he would like to have the report referred back. On the matter being put to a vote the recommendation was adopted.

Insulated Cable

The report of the Electrical Equipment Division was read by A. D. T. Libby, chairman. It covered general specifications of insulated cables, tests, specifications for high-tension (secondary) ignition cables, low-tension (primary) ignition cables, rubber-covered lighting and starting cables, varnished cambric insulation starting and lighting cables, armored starting and lighting cables and a revision of electrical equipment nomenclature. The 7-mm. size was recommended for all high-tension cable.

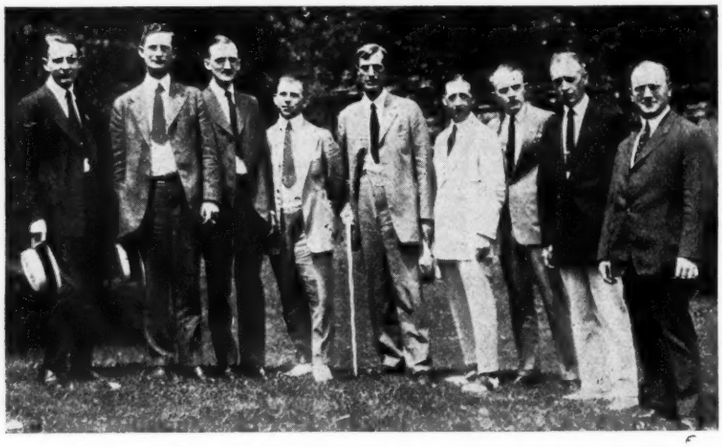
This was objected to in a communication from H. B. Burley of the Boston Insulated Wire & Cable Co., a member of the committee, who said that about one-half of the high-tension ignition cable supplied by his firm was of the 9-mm. type. The production of this cable was a matter of evolution. His firm had been called upon to supply cable for some unusually severe service, for which the 7-mm. cable was found inadequate. To this objection the reply was made that 7-mm. cable had been found satisfactory on motorcycles, which was about the severest service encountered in automotive practice. One objection to the use of more than one thickness of insulation is that all connectors and clips also have to be made in more than one size. The report was adopted as read.

That section of the report dealing with nomenclature also led to some discussion, especially as regards the proper name for that part of the ignition system which performs the functions of a circuit interrupter and a spark distributor. The report recommended timer-distributor, and this part also was adopted without change. Another recommendation of this division that was adopted was to cancel the present S. A. E. standard for magneto flexible disk couplings and insert the following note under the drawing of the standard magneto mounting: Magneto couplings shall be 2⅜ in. long and have a maximum diameter of 3¼ in.

Battery Rating Cancelled

L. S. Keilholtz presented the report of the Isolated Electric Lighting Plant Division, which related to a new proposed rating for farm lighting set storage batteries. It was recommended to cancel the present intermittent discharge rating and adopt instead a method of rating based on the number of hours' discharge capacity at a constant discharge rate of 300 watts. Mr. Keilholtz explained that he was personally much opposed to the recommendation of his division, and he moved that the report be referred back to the division for further consideration. After extensive discussion pro and con, it was voted to adopt that part of the report recommending the cancelling of the present standard rating and to refer the rest of the report back to the division. This leaves the S. A. E.—provided the action is approved by the membership's letter ballot—without a battery rating standard for isolated lighting plants.

The report of the Lighting Division was read by C. E.



Bearings Group, F. H. Lennox, H. C. Brunner, O. P. Wilson, D. P. Chambers, F. W. Gurney, Norman Bell, H. D. Rumiman, H. G. Freeland, F. M. Germane.

Godley, chairman. This covered headlamp brackets, motorcycle headlamp mounting, lamp nomenclature and bases, sockets and connectors; it was adopted.

Ball Studs Report

There was considerable opposition to the proposed recommended practice for ball studs, both from representatives of manufacturers of such studs and from representatives of car and truck manufacturers. It was claimed that on one particular size the neck dimension was too small to permit of the required angular motion of the ball in the drag link. No provision was made for running out the thread chasing tool, the type of nut which was intended to be used was not mentioned, and M. C. Horine stated that, since the ball had to engage with surfaces produced with standard reamers, the ball diameters should be slightly below the nominal sizes. A vote was taken, and it was decided to refer this part of the report of the Parts and Fittings Division back to the division.

Exhaust Pipes

Some discussion also arose over the proposal that the outside diameters of exhaust pipes extending from the engine to the muffler shall conform to the following inch sizes: 1, 1¼, 1½, 1¾, 2, 2¼, 2½, 2¾, 3, 3¼, 3½ and 4. Menges said that in stationary engine practice it was customary to use wrought iron pipe, and there was some possibility of the sizes given being mistaken for wrought iron pipe nominal sizes. The recommendation was adopted with the proviso that the wording be so amended that there can be no possibility of mistaking the scope of the recommendation.

Two other items were covered in the report of this division; namely, square shaft fittings and universal joint hubs, and both were adopted as offered. By the item on square shaft fittings the thread at the end of the shaft is changed to an S. A. E. standard thread, which brings the square fitting in line with the taper fittings.

The universal joint item specifies the hub dimension and the distance from the end of the bolt projecting from the flange to the outer face of the hub.

The report of the Engine Division, covering slight change in the thickness of cast iron carbureter flanges and extension of the disk clutch flywheel housing standard, was adopted as read.

The report of the Screw Thread Division, covering proposed recommended practice in the matter of drain cocks, was adopted as read, after some discussion, in which the use of the ⅛-in. size on radiators was criticized. It was made clear that this size was not specifically intended for use on radiators but could be used in other places; on the carbureter for example.

Social and Sport Features

THE social and sport features of the semi-annual meeting were never better handled, and despite the handicap of the weather conditions a good time was had by all who were willing to enjoy themselves.

The great atrium, or rotunda, in the center of the circular hotel building was an ideal playground for the evenings and for loitering and conversations during the showery days. Also, it supplied all of the elements of out-of-doors with a relief from the sun for those who did not care for southern Indiana spring temperatures.

In this atrium the evenings were especially gay. Without being in each other's way, there were the dancing party each evening, with just as much space as was desired; private card parties; informal receptions by those who had a large list of acquaintances among the members; family parties; playgrounds for the few children present, with plenty of floor space to spare, and had C. F. Kettering carried out his threat to come in his airplane, there would have been air space for him to have staged a stunt exposition. But there were no airplanes present—much to the regret of those who were looking forward to an aerial sport program as a part of the meeting. Kettering and his plane were both missing.

In addition to this very liberal allowance of space, there were a large office lobby of a more formal sort and great stretches of porch, an ample lawn and acres and acres of near-mountain land, on top of which was a very sporty golf course.

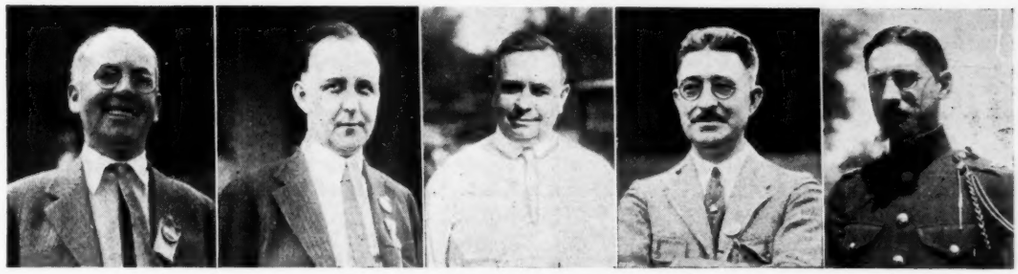
Indeed, it was one of the interesting features of the meeting to see golfers in their tweeds taking a taxi for a five-minute ride up the hill to the course where they would spend several hours walking on ground almost as rough as the hillside. The game completed and the score safely in the hands of the men in charge of the contests, the players again immediately forgot the benefits of physical exercise and called the taxi and rode comfortably to the hotel. While this was going on, scores of non-golfers were climbing this same hill for exercise. The golf events were especially well contested and were conducted continuously despite the showers.

The most notable feature of the sports—to judge by the scores—was the trap shooting. For each of the four days there was a score of 49 out of 50, and on more than one occasion it was necessary to shoot off ties at this score. J. A. Fesler made this score on two days and D. F. Fesler and W. H. Miller equaled his shooting.

The ladies' events on the sport programs attracted the largest crowds, and there was always something on the grounds when the weather permitted. There were many close contests, much good-natured rivalry and many new acquaintances formed here.

The tennis players had a difficult time of it. The courts

F. E. Watts nominee for second vice-president, representing motor car engineering.



Mark Smith, Disguised as "Capt. Merino, eminent representative of the Italian Goverment."

Chas. S. Crawford V. G. Apple F. N. Nutt

were the poorest part of the West Baden equipment, and the rain played havoc with the arrangements. The matches were started on Tuesday, but after two days' necessary recess a fresh start was taken Friday and a busy afternoon resulted. When dark came the matches were not completed and the winners in these events did not get to walk up before the Friday night crowd and claim their prizes. A proud moment in the lives of these champions was destroyed by the fickle Indiana rain god. So here are the results: Men's doubles—Final round, Bates and Buetner defeated Crane and Clarkson, 6—3, 0—6, 6—4. Men's singles—Final round, Clarkson defeated Buetner, 6—1, 6—1.

There were the usual stunt features, and it is no reflection on any previous program to praise them. The most pretentious was Indiana Night, staged after dinner on Wednesday evening. It was the plan that former Senator Albert Beveridge should be the speaker, but he was unable to be present. The committee was fortunate in being able to obtain former Senator Thomas Taggart, an Indiana political power, as a substitute. Taggart is the owner of the French Lick Springs Hotel, a rival to the West Baden Springs Hotel, and he gladly came from his entertainment palace to speak to the biggest convention the rival hotel has housed. His talk was on the practical side of the good roads question. It was at this meeting that a telegram from Gov. McRea of Indiana, extending the best wishes of the people of the State to the convention, was read.

After the speaking program, the annual Indiana stunt was presented. It had been quite a serious program and there was no surprise when an Italian army captain was introduced to speak on the automotive developments of the Italian engineers. He started well, explaining some highly technical lantern slides, when a considerable amount of disorder developed in one section of the dining room. When this racket continued, several of the more serious members of the society left, feeling that an eminent and worthy guest was being insulted. As they reached the hall they heard loud applause and laughter, and returned to find that the supposed scientist was really Mark Smith of Chicago. Several favors were distributed at this meeting.

On Thursday afternoon the Cleveland section staged a circus in the center of the atrium, and the quantity of peanut shells left on the floor was a strong feature of the occasion. The performers did their part well, and much amusement was experienced by those present. It is said to be a matter of record that this was the only session of the meeting at which the attendance was greater at the finish than at any other period of the meeting.

J. L. Yarian, S. R. Castor, C. P. Grimes

After dinner on Thursday the Metropolitan Section invited all present to come to the convention hall to hear Prof. Albert Einstein, the German scientist, explain his theory of relativity. The hall was well filled and the eccentric-looking visitor was well introduced by H. M. Crane in a talk which a portion of his audience understood and which betrayed not the slightest gleam of humor. Then came a heavy mathematical talk in an unusual German dialect which progressed nicely until by a premeditated accident it was revealed that the speaker was Cornelius T. Myers, who was quite well disguised and who had acted quite unlike himself.

The last night of the meeting was—according to precedent—designated as Ladies' Night and was quite a brilliant occasion. It brought out an unusual showing of evening gowns and the politest garments the men had brought along. The first feature of this occasion was the dancing contest, in which a dozen couples entered. The judges had quite a difficult task in the elimination, and be it said to the credit of the ladies that most of the eliminations were due to the hopping proclivities of the men.

After the dancing contest came the distribution of the prizes, and here the organization headed by Howard A. Coffin proved themselves. The usually troublesome task of distributing so many prizes went off smoothly, and was quite an interesting feature of the evening. A special vote of thanks was registered in loud tones for each person on the sport committee, with a cheer for Miss Mattle of the S. A. E. staff. The only sport disappointment was that the section baseball games and similar sports had to be abandoned.

As this was the last night of the session, the hotel management suspended the usual rule for midnight quiet, and music and dancing continued until almost breakfast time.

The Aeronautic Session

(*Continued from page* 1156)

propriation of $50,000 for a landing field for the Post Office airplanes but now they wanted their money back. He expected some good results from the reorganization of the Aero Club of America which up to now had been nothing more than a local organization, but now, under the leadership of Howard Coffin and of A. G. Batchelder, who had done good work in the A. A. A., it was to be made a national organization. It was planned to secure thousands of members and with nominal membership dues of, say, $5 or $10 each, there would be considerable funds available for propaganda purposes.

Routine Factory Tests and Final Inspection of Packard Engines

Operations include five hour running-in during which engine is driven by an electric motor, and two hour dynamometer test in silent room, where measurements of power developed, compression pressure of each cylinder, fuel consumption, etc., are made, and noises are located.

By J. Edward Schipper

THE final step in the routine manufacture of the Packard passenger car and truck engine is a very thorough test and inspection of each engine. After final assembly is completed, all engines are put through this same test, which is in very noteworthy detail and provides an accurate check on the condition of every engine before it leaves the factory.

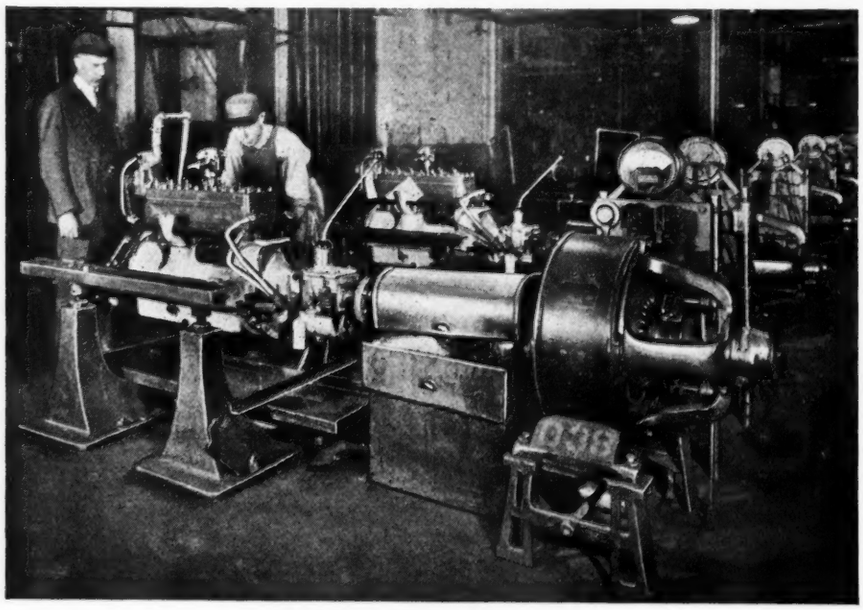
When the engines leave the final assembly department they are brought to a running-in room where they are run-in by electric motor. The transmissions are completely assembled with the engine so that the engines are run-in through their own gears. The first run is for 1 hr. in high gear. The electric motors which drive the engines are direct connected and run at a constant speed of 625 r.p.m. during this period. The amperage required is from 6 to 7 at the start of this run. Following the 1-hr. run at 625 r.p.m., the engine is given a 4-hr. run in second gear, during which the engine turns at 1000 r.p.m.

During the run the engine is gone over to locate leaks, scores and all the troubles which it would be possible to locate in an open room of this kind with several engines being run-in at the same time. When the engines are put on the running-in stand, a dynamometer inspection card is attached to the engine. This card stays with the engine during this running-in process and during the subsequent operations necessary to the completion of the inspection and tests. On this card are listed all of the probable troubles which can be detected during the running-in period as well as during the subsequent dynamometer inspection. Few notations can be expected on the card during the running-in process, which is purely a matter of working in the bearings and putting the engine in condition to run under its own power. The wattage required to run the engine or, in other words, its frictional resistance to being turned over by the electric motor is, of course, entered, as well as the number of the jacks or electric outfits employed in the running-in process. The engine is checked over for tightness of all of the nuts and bolts which can possibly become loose.

The motors used for running-in are Westinghouse direct-current type, 15 hp., 230 volts, 57 amp. The motors are operated on 220 volt, direct current, generated in the Packard plant. As soon as the 5-hr. running-in process is completed the engines are brought to a bench where the spark plugs are put in and the ignition is timed. This is set by a mark on the flywheel 1½ in. ahead of center with the spark lever in the full advanced position.

The engines are then lifted from the rack on which they were taken to the bench and rolled by means of an overhead track to the dynamometer rooms. There are 15 of these so-called "silent" rooms, each capable of handling an engine every 2 hr., or 5 per day, giving a capacity of 75 engines per day in the passenger-car department. The dynamometer equipment consists of Sprague 150-hp. dynamometers.

Including the mounting and dismounting of the engine on the dynamometer stand, there are 32 operations in the dynamometer room. These are as follows: 1. Connect engine to dynamometer stand. 2. Connect all controls and examine generator brush. 3. Check all nuts for tightness. 4. Check line-up of valves and push rods. 5. Measure and adjust carbureter spring. 6. Run engine with dynamometer. 7. Try oil level. 8. Try valves for riding. 9. Locate and stop compression leaks. 10. Start engine on own power. 11. Check generator for groan, and open circuit and see that ammeter reads

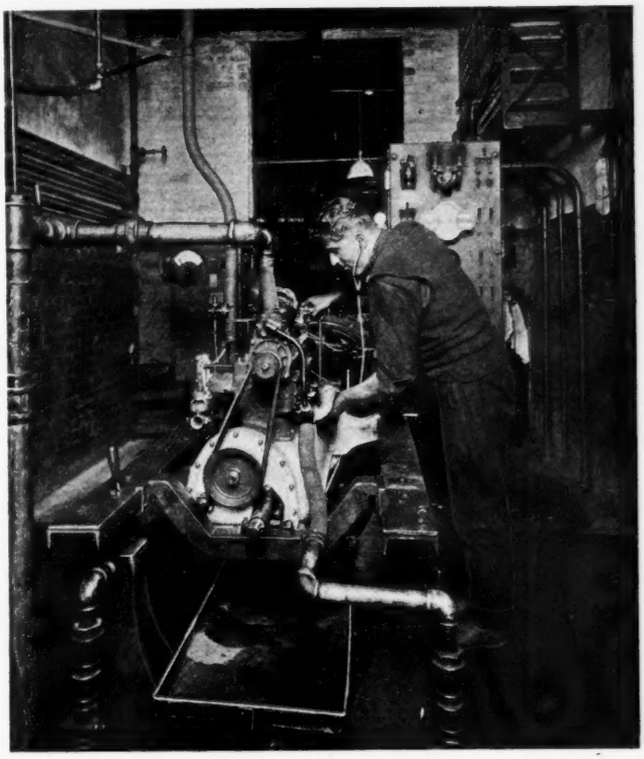


TESTING PACKARD ENGINE
Packard single-six engine on the running-in stand, where it is driven by direct connection with an electric motor.

correctly. 12. Try cylinder for knocks and scores. 13. Give engine hard run for 10 min. 14. Look over engine carefully, tighten all nuts, locate leaks, cracks and sand holes. 15. Throttle engine to observe low-speed performance. 16. Take power curve from 400 to 1800 r.p.m. 17. Check for gasoline mileage. (This is done on a special device which measures out 1/20 of a gal. The engine is set to pull 21 lb. on the dynamometer and the engine must run from 153 to 160 sec., which is equivalent to about 19.2 to 20.5 miles per gal.) 18. Set the oil pressure. 19. Try cylinders for knocks and scores with stethoscope. This is the Locophone made by Baylis company. 20. Try the transmission at first, second and third speeds for lost motion in the shifter shaft. 21. Examine clutch for release, rough plate knocks and growls or slipping. 22. Try the tire pump. 23. Try the starter gears. 24. Try the front-end gears. 25. Try the cylinder base for oil leaks or gasoline leaks. 26. Look for exhaust and air leaks. 27. Throttle engine and try for low-speed miss, low to 100 r.p.m. 28. Check the carbureter. 29. Idle five min. for smoke. 30. Set the push rods. 31. Take compression on standard compression gage. This is the compress-o-meter made by the Brown company.

The engine, after this routine work has gone forward, is taken out of the rack the bottom taken off and washed out and the bottom screens, which have hitherto not been assembled in the engine, put in. After the bottoms have been washed out and the engine examined all over for loose nuts, loose cotter pins, flaws and defects of any kind, the bottoms are put on and the engine sent to stock.

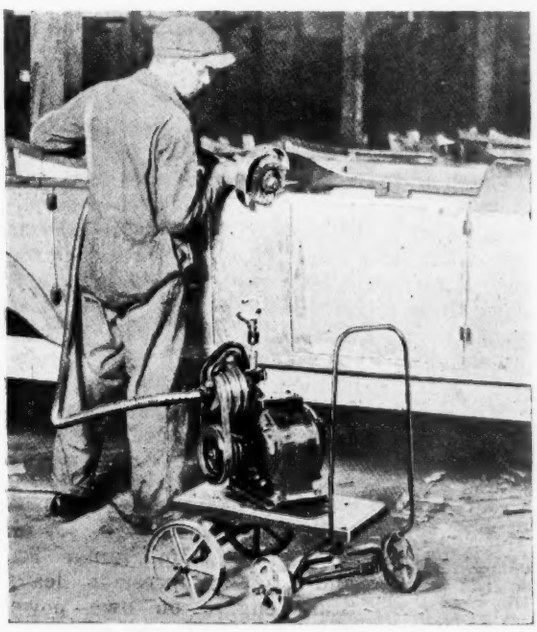
As a final inspection, the engine is sent out on the road test with a road-test card attached, as shown. The majority of troubles to be observed are, of course, not engine troubles, but this enters in. It is interesting to note that the final road test is an administrative department matter entirely and out of the hands of the factory. That is, the road testers are responsible to the president of the Packard Motor Car Co. and cannot in any way be held to factory or shop requirements. Thus, the final check-over of the car is independent of anything which may have been done as a plant operation.



Testing Packard Engine
Packard single-six engine on the dynamometer in one of the silent rooms where final inspection is given

Roughening Aluminum Body Panels

ALUMINUM sheet, as it comes from the mill, is exceedingly smooth and its surface does not hold paint well. It is therefore roughened by mechanical means before the first coat of paint is applied to the body.



Haskins equipment for roughening aluminum body sheets.

The attached cut shows a Haskins Type H-7 equipment in use in the automobile body building industry. These machines are used with a stiff wire scratch brush. The equipment consists of a 1 hp. motor, a three-speed counter shaft (giving spindle speeds of 900, 1800 and 3600 r.p.m.) and 6 ft. of Haskins flexible shafting.

Motor Car Fuel Economy Trial

THE Royal Automobile Club of England has announced its intention of holding a national fuel economy trial on Saturday, May 7 next. The object of the trial is to demonstrate the possibility of obtaining greater fuel economy in the use of a car than is at present generally the case, and it is pointed out that greater economy can be obtained by various methods, such as (a) a more economical adjustment of the carbureter, with very slight depreciation of the car's performance; (b) greater skill in driving, and (c) the fitting of auxiliary devices, such as extra air valves, the last-named method, of course, being obviously only of economic advantage when the saving achieved justifies the expense of the fitting. The trial will take the form of a fuel consumption test of not less than 40 miles and not more than 60 miles on a circular route, on the public road, and it will be open to all comers, whether members of an automobile club or not. Entries will be received from individuals only, who may each enter only one car.

Selling Trucks by Solving Transportation Problems

By specific examples and definite data, the author explains how one truck manufacturer has built up permanent customer good-will and increasing truck sales through analysis of the buyers' transportation needs. The analysis includes material handled, storehouses, and many other factors.

By N. J. Ocksreider*

THE motor truck industry has within the last two or three years entered upon a new period in its growth. The days of experiment and the days of development of manufacture are over to a large extent, although there are still many questions of detail and refinement which the producer has to solve. But we do know how to make remarkably efficient transportation machines at a reasonable cost.

This new era is the result of realization by truck men that a vehicle which is wrongly sold is a liability instead of an asset. In days gone by, too many truck salesmen sold anything they could to haul whatever was to be hauled. As a result much overloading developed trouble or underloading increased expense, and both combined to cause lack of satisfaction not only with the particular truck sold but with the truck as a transportation agent..

Manufacturers and dealers realize today that, so far as possible, they must place themselves in the position of transportation experts, competent to give sound advice on questions arising in this field. Salesmen must be employed who are capable of analyzing their prospects' requirements and these salesmen must be encouraged—they must if necessary be compelled to advise the prospect to act in his own interest even at the cost of losing the sale. It is a great credit to the industry that there are many cases on record where this attitude has been adopted and practiced.

It is obvious, of course, that the manufacturer makes trucks to sell, but it is precisely for this reason that he should see to it that his trucks are sold only where they can perform their work economically. This policy will inevitably develop repeat customers, widespread advertisement and great good will; any other policy will create enemies. The motor truck in its proper place is one of the greatest assets of modern life—misplaced it is an economic waste.

If a salesman is to be sure that his truck is properly sold be must be fully informed about the prospect's requirements and he must be capable of analyzing them honestly and intelligently. He must be able to observe analytically. He must find the truck problem as it exists and prescribe the proper answer. Often an analysis of the customer's problem shows the salesman that the vehicle he sells cannot be used. He must then so inform the buyer and advise him what equipment he should adopt if any is needed.

In the modern business world there are many problems of high class transportation which become too complicated for easy analysis. In literally thousands of cases the buyer himself does not understand his own needs and he does not even have at his command the facts which will make possible an intelligent analysis. It is cases such as this that have developed a new field in the automotive industry—that of the transportation engineer. His is the duty of studying these large and complicated problems and of finding the answer. His purpose must always be the interests of the customer, even if they seem to conflict at the moment with the interests of the selling organization. His object must be to tell the customer in what way he can handle his transportation most efficiently and economically.

It is obvious that in this problem there is involved far more than the qualities of the truck itself. Road and shipping conditions, kinds of freight, methods of packing, seasonal variations in business handled, all such matters as these must be taken into consideration. In the analyses that have been made by the transportation engineers employed by the Packard, recommendations have been brought in involving such varied matters as a new form of package, changes in the arrangement of shipping room and loading platforms, changes in the hours of work, systems for routing and dispatching traffic, and as minor a matter as bagging coal at the yards instead of at the point of delivery. All these things are at first glance outside the range of a truck salesman; actually they have all helped in the sale of trucks and have helped still more in the satisfaction which the buyer has found in the use of his equipment. The reason is that they have all helped him solve his problem and save or make money.

This work falls naturally into two divisions. The first one, which is the field of the transportation engineer, is in studying and solving the transportation problems. The second, which is the work of the truck salesman, consists in the selling on a scientific analysis whether it has been furnished him by a transportation engineer, or whether the immediate problem is so simple that he can analyze it himself. In this article only the problems of the transportation engineer are considered.

When a transportation engineer undertakes the solution of a problem his first need is facts. In instructions issued by the Packard to its engineers there are listed forty-two questions which must be answered before solution can even be attempted. The engineer starts out equipped with note book, camera and usually a large scale map of the territory in which the hauling problem is located. He begins by getting in contact with all the officials connected with the hauling problem and secures a plan of the works, to be used in handling questions of internal routing.

*Chief transportation engineer, Packard Motor Car Co.

He begins his analysis with a study of the material handled, both raw and finished, finds out what it is, how it is received and shipped, in what kind of packages and by what transportation means, whether water, rail, motor truck or team. He studies the question of storehouses and secures data on the amount and kind of material moving in and out of each shipping or receiving point.

Studying Costs

He then takes up the company's present hauling equipment, the number of trucks or horses owned or hired, particularly with reference to peak seasons. He makes a careful study of the cost of this haulage, finding out what the expense is for hiring either trucks or horses, gets the freight rates and the express and motor haulage rates and the frequency and adequacy of the existing freight express, boat or motor haulage services.

He then makes a careful study of operating costs of company owned equipment, both horses and trucks. This cost he divides into fixed and variable charges and if possible reaches ton mile costs on both types of equipment. He studies periods of idleness and the possibility of avoiding them. He takes up the quantity and cost of repair service on the company owned equipment and garage facilities. He learns whether gasoline or oil are properly bought, checked up and handled. He investigates any special equipment that has been used and determines what success it has had.

The next point taken up is the routing and scheduling of the hauling. This is done in detail, finding for what purpose each unit owned is used, and why. He follows this with a study of the road conditions for the year around, including all bridges that must be used. He finds the average and the best possible running time between all points and investigates whether there are any city ordinances which need to be taken into special consideration.

Platform Survey

A survey is also made of all shipping and receiving platforms. In doing this the engineer surveys back of each loading and receiving platform to the shipping or receiving room, watches the boxing, crating, sorting, assembling and internal routing so as to get an idea of the relationship and importance of each platform. He particularly checks up waste of time where products are taken twice over the same ground and where different goods are loaded at different times on the same truck. Where material is being shipped by freight or boat he determines whether it could be handled more economically by truck by learning from the company's records what a saving could be effected on boxing and crating.

Finally he learns the sentiment of the company toward its existing service and equipment, the reasons for desiring new equipment and the attitude of the various men involved toward the equipment that the company offers for sale.

With this material in hand the engineer is ready to start on the actual analysis. The method for this will naturally vary considerably, but in general his task is to establish two things. First, present cost of handling the necessary tonnage. Second, the best possible method for handling the necessary hauling and its cost.

To show how a typical problem of this type is worked out there follows a report made to a corporation at a town in Massachusetts which we will call Blankville, on shipments between its plant and New York City and Newark:

Blankville Analysis

The cost per week to ship merchandise from Blankville to New York City, Newark, and return, by the methods and the combination of methods that have been considered, are presented below:

FROM BLANKVILLE, MASS.:

Using the Standard Motor Express Rate, Plus 3 Per Cent for War Tax

To New York City—$1.00 per cwt. multiplied by 10.5 tons (210 cwt.) of finished product	$216.30
To New York City—$1.00 per cwt. multiplied by 1.7 tons (34 cwt.) of empty drum return	35.02
To Newark—$1.35 per cwt. multiplied by 2.5 tons (50 cwt.) of finished product	69.525
Total cost per week to ship all tonnage by standard motor express	$320.845

Using the Total Freight Rate Plus Cartage Plus 3 Per Cent of Total for War Tax

To New York City—First class L.C.L., $1.11 per cwt. multiplied by 10.5 tons of finished product	$240.09
To New York City—Fourth class L.C.L., $0.72 per cwt. multiplied by 1.7 tons of empty drum returns	25.21
To Newark—First Class L.C.L., $1.36* per cwt. multiplied by 2.5 tons of finished product	70.04
Total cost per week to ship all tonnage by freight	$335.34

*NOTE.—Cartage at Newark end estimated at New York City rates.

TO BLANKVILLE:

Using the Standard Motor Express Rate, Plus 3 Per Cent for War Tax

From New York City—$1.00 per cwt. multiplied by 9.74 tons* (195 cwt.) of raw material	$200.85
Total cost per week to ship all tonnage by standard motor express	$200.85

*NOTE.—Assuming that all phosphate is shipped from Long Island City.

Using the Total Freight Rate Plus Cartage Plus 3 Per Cent of Total for War Tax

From New York City—First class L.C.L., $1.11 per cwt. multiplied by 2.4 tons (48 cwt.) of triphenyl, acetone and miscellaneous	54.878
From New York City—Second class L.C.L., $1.00 per cwt. multiplied by 1.14 tons (22 cwt.) of castor oil and mirrors	22.66
From New York—Third class C/L*, $0.71 per cwt.† multiplied by 6.2 tons (124 cwt.) of phosphate	90.68
Total cost per week to ship all tonnage by freight	$168.218

*NOTE.—It is assumed that phosphate shipments are received in full carload lots, minimum weight 30,000 lb.

†NOTE.—It is assumed that this merchandise is loaded direct into freight cars at the plant from which it is purchased, eliminating a local charge for cartage.

It is obvious that it would not be profitable to ship all merchandise either by Standard Motor Haulage or Freight in either direction. Therefore, selecting from the above a combination of methods most suitable for your requirements, under normal flow of traffic, we have the following combination for consideration:

Merchandise Shipped by Standard Motor Haulage

Finished product from Blankville to New York City and Newark (260 cwt.)	$285.825
Raw material, castor oil, mirrors, triphenyl, acetone and miscellaneous to Blankville (70 cwt.)	72.10
Total cost per week for standard motor haulage	$357.925

Merchandise Shipped by Freight

Phosphate from New York City to Blankville (124 cwt.)	$90.68
*Empty drum return from Blankville to New York City (34 cwt.)	25.21
Total cost per week for freight	$115.89
Combined total cost per week	$473.815

*NOTE.—For the last six months these drums have been returned by standard motor haulage due to an embargo at New York City end.

We suggest the following method to improve the combination method, outlined above, in order that it will be possible to:

1. Place the shipment of both finished product and raw material between Blankville and New York City and Newark on a set schedule.
2. Place the New York office in a position so that their customers may be accommodated to a greater extent than at present.
3. Reduce the present transportation cost.

By installing a Packard size "EF" truck we believe it would be possible to put into operation the following method that would permit you to:

1. Haul the average weekly tonnage of 24.44 tons in two round trips per week at an average load efficiency of 81 per cent.

Equipping a Packard size "EF" truck with a 13 mile axle, it is believed possible to make a round trip between Blankville, Mass., and New York City in three days, each day sub-divided as follows:

Proposed Operating Schedule

Day	Max. Speed M.P.H.	Est. Aver. Speed M.P.H.	Max. Speed Min. Hours on Road	Est. Speed Aver. Hours on Road A.M.	P.M.	Distance	Leave	Time	Arrive	Time
1	13	9	10.1	7.3	7.3	132	Blankville	5:00 A.M.	New Rochelle	8:30 P.M.
2	13	9	1.3	2.0	..	18	New Rochelle	7:00 A.M.	N. Y. Office	9:00 A.M.
2	13	9	5.7	..	8.3	75	N. Y. Office	11:00 A.M.	New Haven	8:18 P.M.
3	13	9	5.6	5.5	2.6	73	New Haven	5:30 A.M.	Blankville	3:36 P.M.

*NOTE.—It is estimated that no hours will be required in New York to exchange loads and that during this interval the truck will cover 5 miles.

Summary

The present cost to ship merchandise by the selected "combination of methods" to New York City, Newark and return is as follows:

Cost per week	$473.815
Cost per day	78.969
Cost per trip	236.907
Cost per cwt.	.97

The operating cost of a size "EF" truck to do this same work is estimated to be:

Cost per week	$331.80
Cost per day	55.90
Cost per trip	165.90
Cost per cwt.	.68

This is delivered to New York City only. To this cost there should be added an additional charge for shipping 2.5 tons of finished product from New York City to Newark at a local charge of 50 cents per cwt., plus 3 per cent of total for war tax or $25 per week, making a total cost of:

Cost per week	$356.80
Cost per day	59.46
Cost per trip	178.40
Cost per cwt.	.73

Comparing the final cost of operating company owned equipment with final cost of shipping by the selected combination method the following saving is believed possible through the adoption of company owned Packard trucks.

	Saving
Per week	$117.02
Per day	23.07
Per trip	58.51
Per cwt.	.24

In a year of 288 operating days it is estimated that this would be an approximate saving of $6,644.16.

To this is attached a detailed estimate of the cost of operating the trucks, which has been summarized in the previous report. As an example of the method of making use of these estimates, there follows one submitted in a report to the New York *Globe*, when it was considering hauling its papers from the St. Lawrence River to Burlington, Vt., during the period of serious freight congestion some months ago. This gives both the basis for an individual truck, and operating nine trucks a week.

OPERATING 9 UNITS FOR A WEEK—18 ROUND TRIPS—250 TONS

OPERATING COST PER WEEK

Figured on 250 Tons

Miles	5040	miles total
Garage 9 units @ $6 per week	50.00	
Driver—8 crews for 3 fleets.	1152.00	24 men @ $8 day for 6 days
Taxes estimated	20.00	for licenses for 9 units per week
Insurance $1.66 per day per unit	89.82	for 9 units for 1 week
Sinking fund	655.20	560 miles per unit per week
Interest	53.10	
Gasoline*	756.00	for 9 units for 1 week
Lubrication**	51.39	for 9 units for 1 week
Tires $.087 per mile	438.48	for 9 units for 1 week
Maintenance and overhaul..	252.00	
Total cost per day	3521.99	
Total cost per year		
Total cost per mile		

Cost of $14.10 per ton

LUBRICATION PER 1000 MILES (Includes refilling)

	Necessary Gallons	Necessary Cost	Desirable Gallons	Desirable Cost
Cylinder oil				
Heavy oil				
Grease				
Cost per mile		.0102 per unit per mile		

MAINTENANCE AND OVERHAUL

Repairs per unit—6 seasons—60,000 miles—total of $3,000.00.
Maintenance and overhaul for life of truck equals $.05 per mile.

TIRES

$877.30 ÷ 10,000 miles = .087 per mile.

MISCELLANEOUS

State license .....
Garage rent per month .....
Driver's wages per day .....
Guaranteed tire mileage .....
Gasoline per gallon .....

ESTIMATED COST OPERATION TRACTOR—SEMI-TRAILER UNIT

INVESTMENT

Chassis		
Freight		
War tax		
Body, top, etc.		
Total	$8777.50	basis for computing interest
Less tire value	877.30	
	$7900.20	

OPERATING CONDITIONS

East Angus and Burlington.
Average 5 miles per hour.
Round trip of 280 miles = 64 hours — with allowance for delays, etc.
2 round trips per week—18 weeks = 10,000 miles—life of 6 years—60,000 miles.

INSURANCE

Fire and theft	
Collision, full coverage	
Liability	
Property damage	
Total	$500.00 per year per unit

SINKING FUND

$7900.02 ÷ 60,000 miles = $.13 per mile per unit.

INTEREST

Formula 6%—6 years—averages = { $307.02 per year per unit / 5.90 per week per unit

GASOLINE

Miles per Gallon		
Good	Average	Fair
2.0 at 30c. per gallon		

*"Average" miles per gallon used in computation.
**"Necessary" lubrication used in computation.

Each problem naturally affords different factors and calls for a different method of solution. One of the problems recently was conditioned upon the hauling that had to be done across a bridge limited to 6 tons carrying capacity. Another was dependent upon the fact that the heavy haulage had to be done over an 8 per cent grade. In a third, that of handling ore from a Colorado mine; the answer was found by putting three trailers to each truck, so that on the haul from the mine the first function of the truck was to act as a break, while it had nearly a capacity load in returning the empty trailers to the pit mouth. Examples like this could be multiplied indefinitely.

It has been working out problems like this that convinced us of the necessity of rating the units sold to the particular job, and abandoning the old flat tonnage rating. It was clear that a truck that might carry 2 tons over an 8 per cent grade could handle 4 tons on a level.

For this reason we no longer sell the truck as of a given capacity, but after studying the hauling problems and determining how much freight should be carried we recommend the units that can do the work most efficiently.

Steel Castings and the Automotive Industry

The use of steel castings in the automotive industry is largely limited to trucks and tractors. The story of the growth of this industry tells the extent to which it has been influenced by automotive development.

THE use of steel castings has been quite extensive in certain phases of automotive construction, despite the fact that the automobile industry has not influenced the steel castings business so strongly as it has some others. Especially in the truck field has the steel casting been widely used, so that the steel foundries of the country can properly be classed as important units in the group which supplies the automotive industry.

Taken as a definite industrial unit, the steel castings industry is comparatively young. It is only during the last twenty or twenty-five years that the production of steel castings has been carried on in any large way. It is said that the first steel castings of which anything is generally known were made by the William Butcher Steel Works in July, 1867. Not until about 1896 or 1900, however, did the steel castings business assume any considerable proportions.

During the very early stages of the steel castings industry, says David McClain in *Foundry*, "great secrecy and caution were exercised in handling mixtures by those whose duty it was to oversee this part of the business, and symbols instead of names were used to specify alloys for steel mixtures."

In 1884 the first Bessemer converter devoted entirely to the manufacture of steel castings was put into operation by the Pittsburgh Steel Castings Co. The early furnaces used in steel casting manufacture, however, were short lived and unsatisfactory in many ways. The acid open-hearth furnace marked a step in advance, however, and about 1896, twenty-five years after the beginning of steel casting manufacture, the installation of a 20-ton acid open-hearth furnace determined the superiority of the open-hearth furnace over the crucible or converter.

The electric furnace is a development of recent years and marks another notable point in the growth of steel casting practice. All three methods are still in use, although the chief obstacle to the more widespread usage of the electric type seems to be that of cost.

There has been a rapid growth in the number of steel foundries during recent years. One authority attributes this to the fact that more men have been taught the technical details of steel casting manufacture, so that many employees have gone out and set up small establishments of their own. He believes that the growth was less rapid during the first decade of this century because there were so few men who really understood how to make steel castings successfully.

At the present time something like 1,000,000 tons of steel castings are produced each year in this country. A large proportion of this output is usually absorbed by the railroads, while the machine builders are also large consumers. While there has been an intimate connection between the steel castings and automobile industries during recent years, it cannot be said that the steel casting manufacturers are strongly dependent upon the automotive industry or that the automotive industry has had a very large part in causing their technical and commercial development.

There are some 250 foundries in the United States which make steel castings. About 190 are independent foundries producing castings for the trade, while about 135 are devoted exclusively to the manufacture of steel castings.

Assuming that the output of steel castings is about 1,000,000 tons a year, the distribution of this output is probably something like this:

Railroads	60%	600,000 tons
Machine Builders	25%	250,000 tons
Automotive Industry	8%	80,000 tons
Miscellaneous	7%	70,000 tons

These figures are merely approximate and are based upon the opinions of several men long connected with the industry in its broadest phases. Definite statistics are not available as regards the steel castings industry. The Steel Founders' Association, which includes the firms producing a large proportion of the total tonnage of the industry, states that it has no information available along these lines and that it is not interested in supplying material or in discussing articles designed to give to outsiders some view of the technical and commercial growth of the steel castings business. Individual members of the Society, however, have been extremely helpful in supplying information and suggestions.

The Society has about 87 members at the present time and, as stated before, these firms produce a very large percentage of the entire output of the industry. Apparently no concerted effort has been made, however, along the lines of co-operative research or tests.

Qualities

The steel casting has characteristics which make it specially adapted to certain automotive uses. Steel castings are made in three grades, generally known as hard, medium and soft. The Society of Automotive Engineers has adopted the standard specification of the American Society for Testing Materials for steel castings. The physical properties required by these specifications are as follows:

	Hard	Medium	Soft
Tensile strength, lbs. per sq. in.	80,000	70,000	60,000
Yield point, lbs. per sq. in.	36,000	31,000	27,000
Elongation in 2 in., per cent	15	18	22
Reduction in area, per cent	20	25	30

The relatively high tensile strength of the steel casting renders it specially adaptable for use on trucks. The following list comprises some of the chief qualities of the steel casting:

1. Relatively high tensile strength as compared with other castings.

2. Machining off even a considerable thickness of metal does not appreciably affect strength of casting.
3. Intricate shapes can be cast which are not at present possible by means of drop forging.

In the early days of steel casting there was a great deal of difficulty experienced in getting the proper metal mixtures to produce the best castings. Progress along this line, however, has gone so far that little trouble is now found. One prominent steel castings man said recently, "Plain carbon steel casting of to-day has been brought to a point where the problems of manufacture are purely mechanical problems. . . . It is, therefore, time to work for better physical properties than those found in low carbon castings straight annealed."

Progress has also been made in heat-treatment methods which has enabled steel casting manufacturers to raise the average tensile strength of their product well above the limits that were previously possible. There is this difference between the malleable and steel casting which is of importance in the consideration of heat treatment and annealing. The steel casting does not rely on the annealing process for the development of any new qualities or properties; the heat treatment merely adds to those properties already present in the inherent nature of the material from which the casting is made. In the malleable casting, on the other hand, the heat treatment serves a purifying purpose and imparts to the casting qualities which it did not previously possess.

It is true, however, that the heat treatment of plain carbon steel castings yields an improvement of 20 to 50 per cent in strength. One manufacturer who has had considerable contact with the automotive industry said recently that "to meet the varied requirements of the truck, tractor and machinery castings we have developed a series of steels with yields points from 30,000 lbs. up to 110,000 lbs., and have obtained higher strength without undue sacrifice of machining qualities."

There are five factors which, in a general way, affect the final quality of the steel casting. These are:

1. Steel making practice,
2. Composition,
3. Moulding practice,
4. Annealing practice,
5. Design of casting.

The automotive engineer is concerned only indirectly with the first four of these factors. It is likely to be to his advantage to understand something of the practice involved in each of them, but he cannot be expected to be thoroughly conversant with all the phases in detail. He is the vital agent, however, in making the casting design. It is because of this fact that he should either understand steel foundry practice rather well or should take advantage of the opportunity for consultation with the castings manufacturer.

This matter of co-operation has been discussed in connection with drop-forgings, die-castings and malleable castings, but bears repeating because of its importance. How important such consultation is from the standpoint of the castings maker and how far back into the process of castings manufacture the design goes is shown by this statement, made a year or so ago by a big castings producer. He said:

"The desire is to persuade the designer of castings that exchange of views is important not only in respect to the production of castings, but also in regard to the use of differing qualities of steel for various purposes."

Two of the chief difficulties, for instance, in steel castings manufacture are unequal cooling of sections of the casting and the presence of blow-holes. As regards the first of these troubles, the design is very largely responsible. Where the sections are of very unequal thickness, unequal cooling is almost sure to take place, while some sections may be too thin to be poured successfully in steel at all.

The unequal cooling can be offset to some extent by "chilling" the thick parts, but there is a definite limit to the possibilities of this method.

Blow-holes come chiefly from improperly melted metal and from wet molds. These troubles have been eliminated in most high-grade foundries at the present time by properly melting the steel and adding to it suitable percentages of silicon and manganese.

There is some indication that the steel founders recognize increased possibilities for development through contact with the automotive industry, and that efforts to increase the importance of that contact will be made at least by individual firms. Discussing the effect of the war on the steel castings business, one executive said recently that it had had two effects:

1. It improved the general quality of steel castings because the Government made large demands, but had very rigid specifications.
2. This large demand developed a very greatly increased capacity for steel castings production.

He went on to state that much of this capacity was now excess and that the big problem before the producers was to develop new fields for the use of steel castings and new markets for the utilization of this excess capacity. He pointed out the fact that even some pre-war uses do not exist now because "the inability of truck and tractor manufacturers to obtain steel castings forced them to eliminate castings and substitute stampings or replace steel with malleable of heavier section."

As regards the function of the steel casting and the drop-forging, one casting maker says, "On quantity orders of simple design it is impossible for casting to compete with forging. But in the development of new models, where production is limited and die expense must be amortized over a few hundred pieces, steel casting is the logical material to use. It is also adapted to intricate shapes which cannot be forged."

Information as Selling Basis

TO successfully sell a truck or tractor means even more than putting the vehicle in the hands of the user and collecting his money for it. The development of a permanent market requires that the proper vehicle be sold to meet the special needs of the particular user, and that proper service be rendered after the sale.

The Bates Machine & Tractor Co. has adopted a plan of going direct to the farmer for information as regards the possible usefulness of a tractor to him. A letter and questionnaire is sent to the prospect. The letter states that it is the earnest desire of the company to sell their tractor only to those who can really show a profit through its use, and explains that the purpose of the questionnaire is to get information for use along this line.

The questionnaire includes such questions as these: Total number of acres, acreage under cultivation, pasture, kind and nature of soil, estimated percentage of steepest grades, number of men employed, number of horses and mules, do you use tractor now, what make, do you own an automobile or motor truck, do you operate a thresher or an ensilage cutter, do you operate a centrifugal pump, what other belt work have you, what tractors have you had experience with, who is your best local dealer

A Foreman's Thoughts of Piece-Rate Cutting

It is a common human failing to attempt to dispose of complex questions by means of a ready formula. It has been said that under a piece-rate system a man is paid in accordance with his ability to produce. This is true, and yet the statement must be qualified. This foreman discusses the matter of cutting piece rates in his own practical, "two-fisted" manner.

By Norman G. Shidle

THE question of a fundamental basis for wage payments is one of the important problems confronting industry. The piece-work system is common to automobile plants, but varies greatly as to the methods by which it is administered. The cutting of piece rates probably causes as much trouble as any other single factor of wage adjustment.

The opinions of employers vary on the subject, while that of workmen is unanimously opposed to the policy. The views of an experienced foreman on the subject should be of interest to executives, since the foreman occupies an intermediate position between employer and employee.

The foreman in question is in charge of a department of nearly 100 men in an automobile factory. The men under his supervision are all piece-workers. The opinions quoted were not expressed in a formal interview of any kind, but merely in the course of a conversation about production methods. His conversation ran something like this:

"Yes, we are getting all the kinks in production pretty well ironed out now in this department. We recently installed a lot of new equipment, and the men are just now beginning to get the maximum value from it. Then they put the whole department on piece-work a few months ago.

"Piece-work has boosted production a lot. I am getting twice the production out of here now with two-thirds as many men as I had before. That is partly due to piece-work and partly to the new equipment.

"But, say, maybe I couldn't get out a lot more production from this gang if they would take off that 75 cents an hour limit on the piece-workers. We get about 400 a day out of here at present, and if they didn't limit the piece-work earnings to 75 cents an hour, I'm sure I could jump production to 600 without turning a hair.

"I've got a good bunch working in here, but when there is a limit like that put on they simply won't turn out any more. Sure, there's a limit. No, we don't tell the men that, but you can't keep that sort of thing quiet very long. It soon gets around the shop. One of the boys was asking me yesterday if it was true that there was a 75-cent limit. I just evaded his question somehow, but he knew just the same.

"And you can't blame them for not going over the limit when they know the rate is going to be cut. I'd do the same thing and so would you; be crazy if they didn't It's wonderful how close they can hit that mark, too. I had a department in a plant up in Detroit a year or so ago. When I went in there production was down low, and all the men were making between $7.90 and $7.99 as regular as the sun rose and set. Later the rate was cut. Every man in the bunch kept on turning in between $7.90 and $7.99 a day just the same. Again I say I don't blame them. I'd do just the same way.

"You can't expect to get maximum production from a man when he knows he is going to be penalized for doing his best.

"Huh? What is the sense of having a piece rate if it has a definite limit? Why not just pay the good men that limit rate and grade the others down accordingly? Hm. Well, now I don't know just what answer you could give to that. It does seem as though a piece-rate system with a limit like that was pretty nearly the same as a day rate basis with a minimum production requirement, doesn't it?

"Well, I don't know about the theory of the thing, but I do know that the boys will hold down production as long as they know the rate is going to be cut when they boost it to a certain figure. If they'd take that 75-cent limit off in this department, I'd soon show 'em some real production. Got a good bunch in here now, and they know that jobs are scarce outside, too."

This is not the opinion of a theorist, but of a practical working foreman of considerable experience in automobile work. Harry Tipper said recently that "of all the systems for general wage payments which are being used at the present time the ones which are predicated upon the relation between the individual and the quantity and quality of his production are the most effective in their general application."

All of which merely emphasizes the necessity of administering as carefully and as fairly as possible this inadequate method which is the best available for immediate use.

A NEW company has been organized in London with the object of reclaiming stale lubricating oil. The waste oil can be bought at prices ranging up to about $100 per ton and in some cases can be had for the cost of collection. It is planned to establish immediately a plant near London with a capacity for treating 50 tons per week, which, it is believed, can be easily collected in London, and other plants in the various large cities of the kingdom. Tests of the waste oil and clean oil made by a consulting analyst are said to have shown the following changes to have been effected by the process: Appearance changed from dark brown cloudy to dark brown clear; the gravity at 60 deg. Fahr. from 0.9180 to 0.9185; the acidity from 0.61 to 0.06, and the water content from about 1 per cent to a trace.

Medical Attendance in Relation to Compensation

Labor interests have seriously opposed the present method of making it the duty of the employer to provide medical attendance in compensation cases. They believe the employee should choose his own physician. T. W. Konop of the Wisconsin Industrial Commission discusses this point here.

ALTHOUGH the movement started too late to publicly gather national force in connection with the 1921 sessions of State legislatures, the proposition of what part the employer and insurer and what part the employee should have in the choice of medical and surgical attendance in the event of injury in industry is already a real national one, and is bound to intermingle with the other big items that are up for consideration in connection with industrial relations.

This question of medical attendance in connection with workmen's compensation is more vital than the item of money indemnity for injury, considered in a broad way. Labor interests are very serious in their opposition to the universal present method of making it the duty of the employer or insurer to provide such attendance. They will make the issue as big as they can.

Interests other than those of either employer, insurer or worker are not in favor of any radical change from the present method, chiefly because they have found that self-interest alone, on the part of employer and insurer, has given the worker entirely satisfactory attendance.

These were the leading thoughts expressed on the subject of compensation for injury in industry at the fourth Wisconsin Industrial Service Conference and Wisconsin Industrial Physicians and Surgeons, held at Appleton, May 17. Wisconsin, the leading State in the introduction of compensation insurance and State control of safety in industry, now has two bills before it on the subject of choice of attendance which are the models for other states, and this formed one of the main subjects at the conference. Thomas F. Konop, former congressman from Wisconsin and a member of the Wisconsin Industrial Commission, sounded the keynote of the discussion.

"Compensation to injured workmen, under our law, comprises two things, medical and surgical attendance and weekly money indemnity of 65 per cent of the average weekly earnings," said Commissioner Konop. "These two benefits are so linked together that they are dependent on each other. The amount of the second depends largely upon the character of the first. The better and more skillful the medical treatment, the lesser the period of compensation disability. Unskillful and negligent medical and surgical treatment lengthens the period of compensation disability, makes compensation costly to the industry and many times unnecessarily makes a cripple of the employee.

"To my mind, skillful and adequate medical and surgical treatment is more important to the injured person and to the employer as well than the money indemnity provided under the law. Skillful and adequate medical and surgical treatment is absolutely essential to the restoration of an injured employee's earning capacity, and yet in nearly all of the compensation laws of the country there are limitations on this service of from two weeks to ninety days or at a cost of from $25 to $300, sometimes both.

"Under the above provision the commission has repeatedly ruled that with this duty imposed upon the employer is a corresponding right to select the physician and surgeon who shall treat the injured workmen. The employer, therefore, is given the right to select, and has been exercising that right and insisting upon its exercise in Wisconsin."

The commissioner then spoke at some length on the movement on foot to change the system and give the right of selection to the employee, although declaring that personally, and he believed the other commissioners agreed with him, he was opposed to any radical change, that he believed the present system was working satisfactorily and that the kind of medical and surgical service that is being furnished to injured workmen is of the best.

Some of the reasons given why the employer should select the physician and surgeon were: He is in a better position to select a competent, skillful physician or surgeon; he is financially interested in the speedy recovery of the injured workmen and will, therefore, furnish the best skill possible; he has to pay the expenses and, therefore, should be permitted to make the best bargain and reduce the cost of this service; where the physician is selected by the employee the treatment is prolonged, bills are padded.

On the other hand, he said, the demand for a change has been growing all over the country. Two years ago a bill to amend the law and give the injured workmen the choice of medical attendant was withdrawn after a conference, when the employers agreed to take the matter up with the insurance carriers and bring about a condition that would give the injured employee the choice of another physician or surgeon if dissatisfied with the one offered, but practically nothing has been done to carry out this agreement.

There are two bills now pending before legislative committees relating to this feature; the Schafer bill would give the injured employee the right to select his own physician or surgeon and the Huber bill gives him the right to make a selection from a list provided by the employer.

Taking up the other side of the argument, Mr. Konop said it is argued the relation between physician and patient is confidential and personal and that sometimes the company physician discloses these confidences; that the best results are obtained

when the patient has confidence in the surgeon; that the physician selected by the employer restricts the period of disability, requiring the injured employee to return to work too soon in order to lessen the indemnity payments; that the physician is too devoted to the interests of the employer; while medical men have complained of the concentration of medical and surgical work into the hands of a few.

The commissioner discussed the various arguments at some length and with absolute frankness. He cited various cases which have come to the attention of the commission to prove this or that argument. He declared the absolute choice of a physician and surgeon by the employee was liable to be detrimental rather than beneficial to the injured workmen, and that one of the first results would be that the Industrial Commission would have to fix the schedule of fees for the medical profession. He said the most skillful physicians and surgeons would object to that to such extent that they would refuse to handle such cases and the workmen would suffer in the long run.

The Future of Airplane Manufacturing

IN a statement just released C. M. Keys, president of the Curtiss Aeroplane & Motor Corporation, asserts that "it costs at least $1,900,000 to develop any airplane motor to the point of successful production." He goes on to point out that the Government idea that airplanes and even aeronautical motors should be bought only under competitive bids is not conducive to scientific progress under these circumstances. The statement continues:

"It is fairly obvious that no company can spend that amount of money and suffer the grief and disappointment of experimental labor—which is so often lost labor—only to have the product of that labor, if successful, taken up by the Government and thrown open to competitive bidding.

"It is fair to say that because of these conditions, over which the industry has no control, not only the Curtiss company, but all other forward-looking institutions in this art, have curtailed their efforts, economized their resources and foregone their ambitions for the art in order to adapt themselves to the policies of their Government."

At the end of the war the Curtiss company was operating seven plants, employing 170,000 workers. It produced 5811 complete airplanes during the war, together with over 5000 motors. The following list indicates not only the location of the various Curtiss plants, but also the various lines of development along which research and progress is being made:

Research, Experimental and Production, planes and motors
Garden City, N. Y.
Churchill St., Buffalo, N. Y.
Rehabilitation and Overhaul,
Waukegan, Ill.
Atlantic City, N. J.
Houston, Texas.
Repair and Supply Depots
Garden City, N. Y.
Waukegan, Ill.
Atlantic City, N. J.
Houston and Dallas, Texas.
Riverside, Cal.
Flying Schools and Fields
Curtiss Field, Garden City,
Curtiss Field, Buffalo,
Curtiss Flying Station, Atlantic City.
Airport, Newport News, Va.
Waukegan, Ill.
Houston and Dallas, Tex.
Riverside, Calif.
Distributors and Agencies
Throughout the United States, Central and South America and the Philippines, thereby vastly extending the service opportunities for users of Curtiss products.

The Garden City plant covers 260 acres. In addition to the shops, this factory contains a drafting department, an aerodynamical laboratory, a 7½-foot wind tunnel, a motor laboratory, chemical and physical laboratories, etc. The Buffalo and Garden City plants take the results of the scientific research made in the other plants and translate them into actual motors and airplanes.

The Curtiss company, according to Mr. Keys, believes in the future of commercial aviation and thinks that "the Government should provide sympathetic regulation, establish airports and lay out routes, etc.," while "the industry must do its part in providing the flyers with economical equipment and good service."

Sulphide Alcohol as Motor Fuel

A GREAT deal of alcohol made from the sulphide liquor of paper manufacture has been used as motor fuel in Sweden during the past several years, and a questionnaire regarding experiences with this fuel was circulated about a year ago by Prof. C. E. L. Hubendick, at the instance of the Swedish Department of Commerce. No less than 668 replies were received. The majority of motor owners had difficulty in getting benzol and sulphite alcohol in a state of sufficient purity, and in many cases trouble was experienced from fouling of the engines and attack of some of the metallic parts. Moreover, many of the carbureters, which were designed to use gasoline, were not properly and completely adapted for the use of alcohol, which resulted in irregular operation.

Of all the reports received only 10 per cent show the alcohol engines to work satisfactorily in every respect. On the other hand, serious trouble was reported in only 4 per cent of the answers. A most serious defect is insufficient preheating of the fuel, which results in abnormal consumption of fuel and oil and also in the deposition of unvaporized fuel which washes off the lubrication oil, and therefore results in increased wear of the cylinder walls in spite of the more liberal supply of lubricant. Incorrect adjustment of the carbureter and the ignition mechanism often leads to improper mixture conditions, incomplete combustion, and, consequently, reduced output.

In many cases there was excessive wear of parts that do not come in contact with the fuel, and this can be explained only on the supposition that the oil was also of poor quality. Some wear of engine parts was undoubtedly occasioned by the iron salts which are added during the preparation of the alcohol. The most serious disadvantage was shown to be the starting difficulty. In a general way the conclusion may be drawn from the answers received to the questionnaire that if the necessary precautions are taken the use of alcohol fuel does not affect the life of the engine detrimentally and there are no serious objections to it.

Production Value of Industrial Incentives

The big labor problem is to provide incentives in industry which will induce the worker to put forth his full capacity for accomplishment. The manufacturer must be as willing to experiment in regard to industrial relations as in regard to mechanics. Changed attitude is necessary.

By Harry Tipper

THE big problem of labor is not the problem of trade unions, I. W. W. or the radicals. It is not the question of whether the demands of the workers are justified; it is not even the question of whether they are misled by their leaders. These things may or may not be. Trade unions are wrong many times. The Socialist's dream is based upon a false idea of progress, the labor leader is no less selfish than the rest of humanity and the manufacturer is frequently arbitrary and autocratic. These things are important mainly because they indicate the amount of time lost in discussion that ought to be devoted to accomplishment.

The main job of industry is to get more work done for less cost per unit of work. Whether this work is done in the factory, in the salesroom, in the accounting department or the warehouse, the work should be planned so that useless motions and waste will be reduced to a minimum.

The big labor problem, therefore, is the production of an incentive for the worker which will enable him or induce him to put forward his full capacity for accomplishment. Anything that will aid this result is important to industry, and anything which reduces this possibility is a detriment to industry.

Obviously, the worker in a majority of cases is not putting forward his full capacity toward useful industrial accomplishment. We know that he is not as interested in his work as he might be. We know that the error in its practice is larger than it should be. Furthermore, we know that these items of waste depend for their correction upon the human element and the proper consideration of the workers within the organization.

Unfortunately, opinions have been formed from circumstances and conditions on all sides, so that people who disagree with one another as to conditions and results are contented with accusing each other of being reactionary or radical, unionists or capitalists, without getting down to the main problem.

When I was selling machinery some years ago it was a part of a salesman's aim to get the engineer to discuss some technical points about the machine, so that the main point of this disagreement would be lost sight of.

Most of our discussions upon the industrial relations has been devoted to this or that system through a union or an open shop, the bonus system or straight wage, until we have almost forgotten that the main problem of industry is production, increased efficiency and speed of accomplishment without a corresponding increase in the unit cost.

If we would get back to this point and stick to it, we would find a great deal of information to be gathered by a study of fatigue and some of the real books that have been written upon the subject. If we would look upon fatigue as something to be avoided in excess because of its effect upon production cost, our consideration of hours, surroundings and other conditions of labor would be measured from the cost standpoint.

Similarly, the question of incentive, the interest secured from the work by the worker, the encouragement to the exercise of judgment would be considered in their relation to the development of production capacity and efficiency, and from that standpoint we would find a great many suggestions in the observations of men who have no industrial management and no experience in handling a factory.

If a flexible system with more responsibility upon the foreman will improve the production efficiency within the plant, the highly centralized system is out of date, and we should reanalyze in order to eliminate its deficiencies.

In these articles the statement has been made that the work must retain the interest of the worker, in addition to the pay, if the full capacity of the worker is to be exercised upon it. As the workers increase in intelligence, it is not possible to maintain their interest in their work unless the work itself offers possibilities of mental improvement and a visibility of growth.

The interest cannot be maintained unless a fair degree of confidence can be established between the supervisor and the worker and the organization system and policy is generally understood.

The suggestions in these articles have been made because they offer possibilities of improving the individual production capacity by harnessing the human incentives to the work of production. Whether these suggestions agree with present practices as generally established is unimportant. Their agreement or otherwise with specific opinions of labor leaders, sociologists or employers is equally unimportant. The sole tests by which they should be measured are those relating to the possible improvement of production capacity and meeting the problem of constantly increasing production costs.

Either it must be admitted that the worker's interest is necessary in order to secure his full capacity or not. If this is not admitted, then the present practice stands justified as the only possible practice —with all its interruptions, troubles and fluctuations in production effort.

When it is understood that human interest in the work is a necessary part of the production capacity for maximum working value, any practice that has established a larger working value per man is worth examination and analysis so that its value may be determined and further experiments developed along similar lines.

Any manufacturer who possessed a machine which was

capable of producing more effectively, more speedily and at less cost would consider himself possessed of a strong competitive advantage and his competitors would be anxious, indeed, to secure equipment of the same character.

In human affairs it is different. Three or four hundred manufacturers in this country in various lines of industry have established experiments in dealing with the human beings in their organizations; these experiments have shown a larger production value, less turnover, elimination of wastes from interruptions and strikes, or some other greater efficiency.

Other manufacturers are not anxious to secure the information of this improved practice, however, and they are very skeptical of its value or its wisdom when they are approached upon the matter. For this reason the experimental changes in the human development of organization grow very slowly. While there is a rapid adoption of machinery which possesses marked advantages, and widespread experimentation with systems that offer new possibilities, there is little disposition to approach the human problem with the same ideas in mind. The improvement of our organization from the human side proceeds very haltingly in comparison with the improvement in its mechanics.

Not long ago a manufacturer was explaining to me a system he had developed theoretically for eliminating the trouble between capital and labor. I asked him how he proposed to put it into effect. He suggested government agencies; after some discussion we eliminated that possibility, and I asked him to try again. He then suggested that the industry might get together and formulate some plan.

We speedily discarded that, and then I said, "If you knew you could secure a piece of machinery which would eliminate a lot of your mechanical troubles and inaccuracy and save a lot of the company's money, you would feel obliged to buy it in justice to the stockholders. You have outlined a plan for human relations which you believe would lead to greater production efficiency and, therefore, more money for your stockholders. Don't you think you are obligated to put it into effect?"

"Well," he said, "maybe I am, but I cannot very well do it, because——"

In other words, this manufacturer was willing to take the responsibility for the investments of the company, the system, the methods and the operations of the company, but he would not accept the responsibility for experimentation with his human organization, although that was the only thing that made the operations valuable.

So long as this attitude prevails, experimentation will be slow, and the understanding of the human necessities within the organization will be developed to an insignificant degree in comparison with the mechanical arrangements of the organization itself.

Bait for House Organs

"WHEN you go fishing it is the taste of the fish, not your personal likes, which determines the kind of bait you use. When you publish an employees' magazine or newspaper it is the taste of the workmen that should determine the sort of material which is printed." This was the statement made recently by James Melvin Lee, editor of *Administration*, in discussing news in employees' papers before a meeting of the New York State editors of such publications.

Several other simple rules of procedure were brought out by Lee which are of interest to the executive should he desire to judge in a general way how far his employees' organ is fulfilling its function. Some of these are discussed in the following paragraphs.

News is far more important feature in these publications than are editorials. News will have a greater influence in accomplishing the purpose of the editor than all the editorials he will ever write. The employees may feel that editorials are inspired propaganda, but news cannot cause such reaction. There may be a large hole in the Main Street of your town for instance, which needs to be repaired. The local paper may write many editorials without getting any action. But if it prints a series of news stories showing how a motor truck got stuck there, how a car bumping through the hole splashed the new spring dress of one of the leading society ladies, etc., the hole will probably be patched up in a few days.

The personal element should be injected into these publications to as large an extent as possible. One Boston newspaper is said to have built up a large circulation and an excellent reputation by mentioning the name of everyone in Back Bay at least twice a year. The small events, such as marriages, week-end travels, visitors, etc., are of great interest to those concerned. The degree to which the personal element is successfully injected into the paper is likely to determine the degree of success with which it accomplishes its purpose.

To make the news interesting, the editor should be able to dramatize the facts when they are presented. Nearly all news stories when analyzed will be found to center around the idea of "struggle" in one way or another. Fires, murders, international relations, industrial relations, deaths—even marriages when they get into the news—all center around the struggle idea. It is this factor which makes the news interesting and vital to the readers. More of the struggle idea should be injected into the news stories of the plant paper, and the facts should be dramatized for the benefit of the reader.

Anecdotes and short, witty stories often help out a news account to a large extent. They liven up the article and help appreciably in dramatizing the idea. In writing their material for house organs, the editors might well take a tip from O. Henry, who is said to have stated something like this: "I just sit down and write an ordinary story. Then I put a little raisin here and little raisin there; then I put a big raisin at the end. And the editors bite on those raisins." And that is just what O. Henry did; it is the little raisins throughout and the big raisin at the end that make his stories distinctive.

Regular advertising is usually out of place in employees' magazines, but a classified column might be run to great advantage. Here the employees could be allowed to advertise free of charge anything they had to sell, etc.

There is a tendency in employees' publications to lack variety. Week after week reading of many of them leaves the reader with a sense of sameness. A proper realization of the value of news, and a proper sense of news values and methods of presentation would go far toward eliminating this fault. The employees' publication is written for the employees; not for the executives.

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A Successful Convention

THE 1921 summer meeting of the Society of Automotive Engineers will go down in the history of the organization as one of the most successful ever held by the Society. Not only were the technical sessions well attended and the papers well discussed, but the meetings were handled in an alert and punctual manner which permitted of definite adherence to the schedule adopted before the meeting opened.

Those who attended the meeting were there primarily to become posted on late engineering developments and exchange information. The papers were excellent and a credit both to the Society and the authors. They furnished much data that will be used for reference purposes for years to come.

The meeting was indeed a liberal education for those who were fortunate enough to attend and will furnish much food for thought and study on the part of members who could not be present.

If any criticism is to be offered concerning the meeting it might be said that there was not quite enough time for discussion, but there was marked improvement in this direction. Some would have liked a larger proportion of papers dealing directly with design features, especially of passenger car chassis, and less leaning toward pure theory, but there was certainly no lack of interest in the subjects selected or the method by which they were treated.

The meetings committee, the S. A. E. staff, those who provided papers and discussion and others who co-operated to make the meeting so successful are to be congratulated and should receive the thanks of the membership.

The Value of Turbulence

THE idea of promoting turbulence of the mixture in an engine cylinder at the moment of ignition, discussed in the paper presented by H. L. Horning at the Society of Automotive Engineers Summer Meeting, is not a new one, but has been given far too little attention by designers and others interested in bettering the combustion conditions which obtain in automotive engines. Flame spread is greatly accelerated thereby with the result that the entire charge is burned more quickly and more efficiently. It is a well known fact that two or more spark plugs fired simultaneously at points some distance apart in the combustion chamber facilitate early completion of combustion and make possible the use of less spark advance. The same is true to an even greater extent when the flame is rapidly spread by turbulence to all parts of the charge. In this way ignition takes place at an infinite number of points almost simultaneously, and since the mixture is quickly inflamed at many points the time which elapses before the entire charge is burned is so small that the flame cannot reach the detonation velocity, and consequently the knock which would otherwise result does not occur or is much less likely to do so, at least so long as too high a compression ratio is not employed. Conversely, the greater the turbulence, other things being equal, the higher the compression ratio which can be employed and the higher the efficiency obtainable.

Mr. Horning points out two methods for obtaining turbulence and shows the advantages gained thereby. His paper is worthy of careful study and should prove instructive even to those who are already well versed in the subject.

Hub Standardization

NOW that the smoke of battle has cleared away and the adoption of the recommended practice on front truck hubs is an accomplished fact, a real panorama of the admirable way that the Standards Committee of the S. A. E. has handled a difficult problem is presented.

It will be remembered that this matter was referred back to the committee at the meeting last January after failing to carry by a very small majority. The ball bearing manufacturers. and doubtless rightly, believed that their side of the case had not had the proper consideration. Subsequent revision of the recommendations have met with the en-

tire approval of all concerned and as a result the report was carried unanimously.

AUTOMOTIVE INDUSTRIES congratulates the standards committee and members of the ball and roller-bearing industry, the axle manufacturers, wood and metal wheel manufacturers and other allied interests on the unselfish co-operation which finally made this result possible. Having vigorously pointed out in its editorial pages the economic waste through lack of uniform practice due to minor and immaterial differences, this publication looks forward to the rapid adoption of a similar report covering front hubs for passenger cars, as a real conservation measure and one which will further the welfare of the entire industry.

Scientific Research

AT the S. A. E. meeting one of the speakers made the remark that during the period of from 15 to 10 years ago a great deal of scientific research on problems connected with the operation of internal combustion engines was carried out in England by such men as Clerk, Hopkinson, Callender, Bairstow, Watson and others, while at the same time in America little attention was given to such matters; now things seemed to have changed around, for aside from the creditable work of Ricardo little research is being carried on in England, whereas in the United States the subject is being taken up with avidity. Prominent among the scientific work on gas engine phenomena being done in this country is that of the Bureau of Standards and of the Research Laboratory of the General Motors Co.

Research work, so far as it pertains to internal combustion engines, may be divided into two classes, namely, research carried on with a view to the solution of immediate practical problems and research conducted with a view to establishing broad fundamental facts without special regard to their immediate practical application. Research of the former kind has been carried on in America practically ever since the automobile industry was first established. It was often conducted with limited means and meager equipment, and the results obtained were seldom published. The making and testing of all classes of experimental devices intended as models for manufacture falls under this head. It must be realized that if a new type of carbureter, for instance, is developed, numerous experiments usually have to be made before all around satisfactory results are obtained, and this experimental work really constitutes research, although it passes more generally under the name of development work.

The work done in England by such men as Hopkinson, Bairstow and Watson was of a different character. Most of it was conducted for the Gaseous Explosions Committee of the British Association for the Advancement of Science. Among the factors determined experimentally were explosion temperatures, changes in specific heats of the products of combustion with temperature, rate of flame propagation, chemical constituents of exhaust gases, etc. These are fundamental factors in the operation of engines, and a knowledge of them undoubtedly enabled engineers to design better engines. The results then obtained are probably appreciated a great deal more now that the necessity of exceeding high speeds and of burning the heavier grades of fuel has confronted engineers with new and more difficult problems than when they were first made known to the public.

If research on internal combustion engines is lagging in England just now, we need not expect that this will remain so for any length of time. Immediately after the war a national research organization was created there for the purpose of encouraging those industries which felt that they could benefit by systematic co-operative research work and were willing to contribute the necessary funds by the grant of Government research subsidies. One of the industries that have qualified for such grants from the Treasury is the automobile industry. Naturally the result of this research work will not be published generally and will be made available only to such firms as contribute to the fund required for meeting the expenses. Also, the work will no doubt be carried on more with a view to immediate practical returns and will therefore be conducted on materially different lines from that of the Gaseous Explosions Committee.

The Individual in Industry

THE question of incentives in industry is often approached from the wrong side. Plans for making workers more enthusiastic about their jobs and consequently more efficient are likely to start by viewing workers as a mass. Actions of "Labor" are considered and the plans devised are formulated on the mass basis.

It is probably true that certain fundamental principles form the basis for human actions and reactions, but at the present time we are far from understanding what these fundamentals are. We cannot hope to understand them except through a long period of conscientious study and experiment. And the analysis of the problem must center about the individual—not about the mass.

The mass is simply the group of which the individuals form the component parts. It can never be understood until the individuals are understood. We must start our work and study with the individual. Industrial relations should be approached from this angle if permanent progress is to be made.

To study human relationships in industry by concentrating on the individual is a tremendous task. Progress is likely to be slow; but once made the progress is permanent. To attempt to solve the difficulties through formulas and mass generalities is to put the cart before the horse.

Though a slow process, the analysis of the individual is really the quicker, because it will record constant progress, while the mass approach leads backward rather than forward. And this constant progress will more than pay in production and profits, as it goes along, the expense and trouble necessary for the analysis.

Americans Sweep Indianapolis Race

Milton's Frontenac Leads Contenders

Eight of First Nine Places Go to Yankee Cars—Engineers Analyze Results

INDIANAPOLIS, May 30—A Frontenac car, piloted by Tommy Milton, won the 500 mile classic here to-day and was closely followed by three other American cars. The second car was a Duesenberg straight-8 special. Third was the Chicago Frontenac and then another Duesenberg. Only nine laps separated these cars when the winner crossed the line. The fifth car was a Sunbeam. Only nine cars completed the race. Continuing in order they were: Duesenberg, Leach special, Duesenberg and a Frontenac.

The drivers in the order in which they followed Milton across the line were Ralph Sarles, Jules Ellingboe, substituting for Percy Ford; Jimmie Murphy, Ora Haibe, Bennett Hill, Ira Vail, Albert Guyot, and Ralph Mulford. The tenth prize was distributed between the drivers finishing the race.

At the beginning of the race, De Palma made a splendid record with his Ballot special for 102 laps. He kept the time well above 93 miles an hour while he was in the running and he carried off something more than $10,000 in lap prizes.

After he went out Sarles took the lead for a time, but Milton soon came to the front and led consistently. Milton's time was 5:24:44.65. His average speed was 89.62 miles an hour, which compares with last year's average of 88.50. Both of these races were for cars of 183 cu. in. displacement.

The track record is 89.84 miles an hour, made in 1915, when 300 cu. in. was the maximum. The Frontenacs are practically the same as the Monroe, which won last year.

Duesenberg Team Work Good

Milton's victory was a reward for good driving of a good car. The Duesenberg group always had some one handy to spurt with De Palma as long as he remained on the track. It is held that De Palma was led into unwise bursts of speed by the splendid teamwork of the Duesenberg group.

While all the deserved glory goes to the victors, it is really those who fail who make the Indianapolis classic of value to the industry. Indeed, for these cars to have run and lost is far better than had they not run at all. Each broken hope, in the form of a shattered part, spells out an engineering lesson which, when interpreted, makes the Indianapolis Speedway the greatest automobile engineering school in the world.

HOW THEY FINISHED

First, Tommy Milton....Frontenac
Second, Ralph Sarles....Duesenberg
Third, Jules Ellingboe...Frontenac
Fourth, Jimmie Murphy..Duesenberg
Fifth, Ora Haibe.....Sunbeam
Sixth, Bennett Hill.....Duesenberg
Seventh, Ira Vail.....Leach Special
Eighth, Albert Guyot...Duesenberg
Ninth, Ralph Mulford...Frontenac
Time of winner: 5:24:44.65. Average speed: 89.62 miles an hour.

When Tommy Milton piloted his Frontenac special to victory he bore out his reputation for being able to size up the staying qualities of his vehicle and his wisdom in not exceeding the pace which eventually proves to be sufficient to win. Too fast a pace was set up by others, probably in an endeavor in some conspicuous instances to win prizes for laps. Ralph De Palma won every lap prize except two up to the 110th, but this burst of speed, which was far ahead of all previous records for the distance, probably cost him the race as he went out on the 111th lap with a burned out rod.

Next to tire stops, which in spite of the hot weather were less numerous than in any previous year and mostly merely precautionary at that, burned out rods and spark plugs were the most prolific causes of trouble and equal in number, there being four cases of each.

Next in order came steering knuckles and water connections with three instances of each. Freezing brakes, valves, ignition and oiling each claimed one victim. As far as the broken rods were concerned, it is more than likely that the trouble with some of these originated in clogged or faulty oiling systems.

Those who suffered were Ralph De Palma in his Ballot special, which looked for a while like an easy winner; Howard Wilcox in the Peugeot, first out of the race; the Talbot-Darracq and one of the Junior specials.

Five Spark Plug Victims

Spark plug troubles were experienced by the Revere, Ballot, Boyer's Duesenberg, Spiel, and Murphy's Duesenberg Special. Those who had the plug troubles had many of them while the others had none at all so that it is very possible that the troubles were of design. Perhaps it was the old fault of not enough water around the plugs.

Two of the Duesenberg specials had broken steering knuckles, showing possibly a weakness in heat treating or material selection. Both cars and drivers, Murphy and Thomas, had narrow escapes as their cars went from one retaining wall to the other, creating conditions with

(*Continued on page* 1183)

Miller Encourages Loans on Car Paper

Kansas City Reserve Head Opens Way to Business—Funds Now Ample

KANSAS CITY, May 31—Two items of motor car paper, said to be paper of distributors of motor cars, submitted by member banks, were rediscounted by the Federal Reserve Bank of Kansas City, during the week of May 23.

Governor Miller of this Federal Reserve Bank sent letters to several of the member banks, announcing that high class motor paper that is solvent and eligible, was being taken.

Governor Miller's most emphatic statement, in the course of an interview with a Class Journal representative, was a declaration that the Federal Reserve Bank of Kansas City is now offering rediscount facilities on automotive paper **primarily and definitely for the benefit of automotive dealers and distributors of the Tenth Federal Reserve District.**

"We are hoping," said Governor Miller, "that our increased liberality toward motor paper will not cause a flood of that paper to invade the Tenth District and absorb the lending power of the leading banks as well as of the Federal Reserve Bank, which ought to be used for promotion of live stock interests. We are hoping that such automotive paper as is offered, by member banks, will be paper of firms and individuals of this district, in the automotive business, and not paper of outside automotive concerns."

In 1920 a great deal of outside motor paper from the automobile and accessory field was bought as commercial paper by Tenth District banks. Most of this was liquidated as it matured and has not been returned to Tenth District banks. None of it, of course, got into the Federal Reserve Bank. It is obviously the desire of the Federal Reserve Bank officials, that each automotive district take care of its own automotive paper.

Has $40,000,000 Reserve

Several factors, not mentioned in his address to the Motor Car Dealers' Association May 21, seem to have entered into Governor Miller's decision to relax the scrutiny of commercial paper. The Kansas City bank is $70,000,000 better off this spring than in the spring of 1920. Then, it owed $30,000,000 to other District banks; that is paid off, and the bank has accumulated a large reserve.

An important factor is the sharp contrast in the attitude of bankers gener-

(*Continued on page* 1183)

Industry Steady as Market Changes

Renewed Sales Follow Reductions in Price

No Repetition of 1920 Slump Likely—Farm and Foreign Markets Opening

(By James C. Dalton)

NEW YORK, May 31—The present decline in buying demand for automobiles is neither remarkable nor unexpected. In fact, if there had not been a falling off in sales at this time it would have been most remarkable. The business of companies which have announced definite price reduction is holding up remarkably well.

There probably are many elements responsible for slower buying. One of the most important is uncertainty in regard to prices; another is the usual seasonal slump, and another is bad weather. Spring sales began earlier than usual this year and it is only a natural sequence that they should slow up earlier. The slackening demand did not come unexpectedly to anyone in the industry who has followed the situation closely. There always has been a dull season in summer for the automotive industry. There are few industries which do not have dull seasons.

In recovering from periods of depression, industry and commerce always have ups and downs. There is no steady upward trend, with business increasing each month, nor does trade remain stationary. But business seldom slumps back as far as it did at the height of the depression, and each rebound carries it a little farther forward than the last one. That undoubtedly is what will happen now with automobiles.

Sales Pace Production

It is not likely that sales—and sales now are synonymous with production—will drop back to the low levels of the last months of 1920 and the early days of 1921. Trade will depend to a greater extent than it has since March upon general business conditions. These should show a marked improvement by early fall. Predictions in times like the present are foolhardy, but it can be said safely that there are more elements tending towards stability than there have been since deflation began a year ago.

The general buying power of the country has now approached its lowest ebb, except for those unfortunates who have been compelled to draw on their savings to meet current expenses. The outlook is brighter now than it has been in years for those with fixed incomes and for the salaried workers whose positions are secure. They are finding the purchasing power of their dollars constantly increasing. There are many thousands of families in this class who, if they are not now in a position to buy an automobile, soon will be. The difference between their earnings and their expenses is steadily widening as the cost of living slowly but surely declines. These families are the ones which make the best prospects.

Industrial Conditions Spotty

Industrial conditions throughout the country are "spotty" and they will continue to be for some time to come. There is less depression in some districts than in others, and those sections which are most prosperous naturally offer relatively the best sales territory. Intelligent sales efforts will bring results now as they always have. The wiser sales executives are not mapping out arbitrary campaigns and sticking to them. They are keeping their forces mobile and making quick, decisive raids in the districts where the most money is to be found.

Sales resistance in the great agricultural sections is slowly breaking. It cannot be said truthfully that the farmers are buying feverishly as yet, but they are displaying increasing interest in what they consider real bargains. This is shown by the greater volume of sales reported by the great mail-order houses which find their best patronage on the farms. Holdings of last year's crops gradually are being turned into cash and the outlook for the present season is most encouraging. By fall the buying appetite of the farmer should have been whetted to such an extent that he will consider purchasing the motor vehicles he sorely needs.

Domestic business is inextricably bound up in foreign trade, and in this direction there are distinctly encouraging factors. Chief of these is settlement of the German reparations question and the evident sincere desire of the present German Government to meet its obligations scrupulously. A better feeling already is apparent in Europe. The Silesian question probably will be settled without further bloodshed and the justifiably militant attitude of France has been modified to meet the Teutons half-way. if it finally is demonstrated that they intend to meet squarely the burdens imposed upon them for drenching the world in blood.

Reparation Treaty Helpful

The stabilizing effect of the reparations settlement already is apparent upon the continent, and European nations soon will be coming into the market for the purchase of American goods

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Argentina to Take Cars in September

Will Clear Present Stocks by New Season's Opening—Ford Manager Resigns

NEW YORK, May 27—Contradictory statements concerning the automotive situation in Argentina are cleared up and the promise held out that new business will be gotten under way in time for the opening of the sales season in September, in information received from M. T. Meadows, manager of the American Chamber of Commerce, Buenos Aires. This observer declares that the stocks of cars held in the Argentine on May 3, when his communication was written, represented no more than a two months' normal supply.

"I feel that I can assure you that the friendship and goodwill of the Argentine dealer and importer is not lost," Meadows states, "so that the resumption of the sale of American cars on a large scale is merely contingent upon the revival of business activity here.

"In effect the large car stocks, reported in a previous statement, are gradually being liquidated and are now figured as standing at about two months' normal supply. However, owing to the general business depression still prevailing, which is reflecting most unfavorably in the automobile market, it is probable that the present supply will carry us through the winter and very few new cars will be needed until the opening of the spring and summer selling season in the coming month of September.

"I also feel sure that our American manufacturers have shown a ready disposition to get together with their local dealers and that eventually the situation will adjust itself in a manner satisfactory to all concerned."

The resignation of E. H. Hampton, as manager of the Ford branch at Buenos Aires, also is reported, as one of the results of the change of dealership territorial rights, similar to the changes made in this country several months ago. This action in taking away the exclusive territory rights has evoked a storm of protest from the Argentine agents who number about 325. Hampton became the Ford manager at Buenos Aires in 1912, when Ford sales were 30 yearly.

COLUMBUS TIMKEN RESUMES

COLUMBUS, May 31—The Columbus branch of the Timken Roller Bearing Co. has now 260 men on its payrolls and additions are being made constantly, according to Charles N. Replogle, general manager.

Ace Truck to Sell Direct from Factory

Elimination of Dealers, Company Says, Permits Price Cuts of $455 to $655

NEWARK, OHIO, June 1.—The American Motor Truck Co., manufacturer of the Ace truck, has eliminated distributors and dealers from its selling plan and hereafter will distribute its product direct from factory to user through a system of zone offices. Coincident with the change of policy, the company has announced a reduction of $455, or 16½ per cent, on the 1½ ton model and of $655, or 23½ per cent, on the 2½ ton model. The new prices are $2295 on the 1½ ton and $2795 on the 2½ ton.

The new Ace plan, originated by C. L. Bowler, general manager, was first tried out beginning Feb. 1. In 60 days in three zones where the test was made, 396 garagemen were retained to handle the service work and these garagemen, operating on a basis whereby they will be paid $150 each for names of prospects who later buy trucks, turned in more than 1400 prospects. Up to date 14 zone managers, recruited from the ranks of factory and distributor sales representatives of various truck lines, have been appointed and it is planned now to develop the new selling system on a national scale under the direction of Glenn B. Hiller, who became general sales manager May 1. Hiller formerly was general sales manager of the Nelson Motor Truck Co. and later assistant general manager and director of sales and advertising of the Triangle Motor Truck Co.

The Ace will develop new selling zones gradually by sections throughout the country, eventually, according to the present plan, having between 200 and 300. In each will be a zone manager in charge of sales and service, a zone service supervisor and as many salesmen and traveling service men as are necessary. The zone managers and their assistants will all be factory employees, those in the sales department working on commissions with drawing accounts.

Will Have Service Depots

It is planned in each territory to have a central parts depot or two or three if necessary, and 200 or more service stations handling monthly inspections of all Ace trucks in the territory and doing necessary repair work. These service stations will also obtain prospects for new truck sales. They will be allowed $150 on each prospect who later buys and they will be permitted to get the cooperation of drivers and others to obtain prospects in which case $50 of the $150 will go to the tipster. Selling will be handled exclusively by the zone manager and his salesmen.

Service stations will make no investment in parts, obtaining these as needed from the zone parts depot, which it is expected in most cases will be not more than 25 miles distant. The zone service man will check up the service station on the quality and prices charged for repair work. For the inspection service, which includes four inspections of three hours each the first month after a truck is delivered and one of three hours each month thereafter for 11 months, the service station will receive $45 from the factory, this inspection being free to the owner. The owner carries a coupon book entitling him to the inspections which he can obtain in any garage serving as an Ace service station. Garagemen for this work will be selected preferably from those having no car or truck agencies.

The company will do no trading but through its zone managers and service stations will sell used trucks for new truck buyers on a commission basis. New trucks will be sold for 50 per cent down and the balance in six months, the American Motor Truck Co. doing its own financing. In the contract will be a provision under which the owner pays a flat rate of $150 on the 1½ ton truck and $182.50 on the 2½ ton truck for interest on the time payment over the six months period and for insurance on his truck for one year.

The company states that the reductions in its list prices were made possible through the reduction in selling cost under the new plan.

Louisiana Motors Head Temporary Receiver

SHREVEPORT, LA., May 31—Acting upon application of creditors who hold notes against the Louisiana Motor Car Co., W. F. French, president of the company, has been appointed receiver by the court according to the petition asking for receivership. The unpaid debts of the concern amount to approximately $150,000 with assets amounting to more than $900,000.

The appointment of a temporary receiver to manage the affairs of the company whose automobile factory is located at Cedargrove, near Shreveport, was agreed upon at a meeting of the board of directors. At the request of the petitioners, W. F. French, president of the company, was appointed by the court as temporary receiver. The only reason given for the request for the receivership is that the company owes debts which it has not the means available to pay. The factory has been temporarily closed down, but it is announced will resume operation soon.

DART TRUCK IN RECEIVERSHIP

WATERLOO, IOWA, June 1—To avoid complications following the death of President C. C. Wolf of the Dart Truck & Tractor Corp., who was also cashier of the State Exchange Bank, W. H. Johnson, former vice-president and general manager of the company, has been appointed Dart receiver and will continue the business. The company's inventory of materials for trucks and tractors is declared to be in excess of its obligations.

Penn Motors Names Trucks for Dealers

Applies Brand Idea to Commercial Vehicles—Will Make Passenger Car Later

PHILADELPHIA, May 28—Something distinctly new in the policy of truck manufacture is in operation at the new factory of the Penn Motors Corp., Rivington, N. J., whose headquarters for sales is in this city. Hilton W. Sofield, president of the corporation, said the corporation will manufacture Penn trucks for the dealer, this being an application of the brand tire idea to trucks.

While the product of the factory will be generally known as Penn trucks of two tons' capacity, the corporation, as a special inducement, and having in mind the benefit of the dealer, will, where the dealer prefers it, have the trucks made with his name on the radiator and rear, exactly as if they were manufactured by him, thus not only advertising the dealer, but also giving the truck for that territory an individuality. There are certain restrictions, however, where the dealer's name is used.

Already orders for more than 100 trucks have been received and it is expected that the first will be finished within six weeks. There is one large building, 80 by 220 ft., in use at the factory, with several small outbuildings. It is planned to manufacture a light delivery truck in time, and before long the matter of making a passenger car will be taken up.

Speaking of his new plan, Sofield said: "We had in mind making it easier for the dealer, who very often, just after he has succeeded in working up a good business, is informed by the factory that he will be removed from the territory and a branch factory established at that point, 'because business seems to warrant it.' Usually this business has been made possible by the man who, in such a case, has to suffer for it, instead of being rewarded."

The officers of the Penn Motors Corp., which is incorporated under the laws of New Jersey, are: Hilton W. Sofield, president; Howard S. Sofield, treasurer, and Charles B. McGuire, secretary. The directors are the foregoing and Dr. W. W. Beveridge, L. H. Collins and George A. Small.

The authorized capital stock is $300,000.

REVERE SEEKS $1,250,000

LOGANSPORT, IND., May 31—The financial condition of the Revere Motor Co. remains almost unchanged. The necessity of selling $1,250,000 of stock for refinancing and placing the factory in production is admitted to be considerable of an undertaking. It is practically certain that the money cannot be obtained in Logansport, despite the fact that quite a few prominent Logansport men have gained control of the crippled organization.

War Gave America World's Tire Trade

British Manufacturers, Seeking Protection, Declare United States Far in Lead

LONDON, May 6 (By Mail)—Urging protection for the British tire industry, the British Rubber Tire Manufacturers Association, Ltd., has prepared a memorandum in which it outlines the precariousness of the situation caused by American imports, unfavorable exchange rates and loss of Continental markets. The memorandum says in part:

"The rubber tire manufacturing industry in Great Britain is assailed by severe foreign competition, which is having a most serious effect on the industry. A great deal of this competition is from the United States, where, owing to overproduction, the home market is overloaded with tires, and the remainder from Continental countries with a depreciated currency. It can, therefore, hardly be classified under the heading of 'dumping' in the usually accepted sense of the term. The effect of this foreign competition at home and abroad is already felt to such an alarming degree by British manufacturers, and the position is so serious, both to the employers and the workpeople engaged, that unless immediate protective steps are taken the industry will be gravely affected.

"Before the war, although subject to fairly keen competition from France and Germany, the British tire industry did not experience any serious competition from America, and, generally speaking, was able to hold its own. In motor tires particularly, a branch of the business which was then attaining large dimensions in the United States, the American manufacturers had failed to make any effect on British home and Colonial markets, and in many Continental and foreign markets where the British manufacturers had a strong hold.

"The importance of the tire industry to the nation cannot be over-estimated. Motor transport is impossible without tires, and a state of affairs in which the nation had to rely upon foreign supplies in time of war would be unthinkable.

War Service Important

"The important part played by the British tire industry during the war cannot be over-rated. Under circumstances of extreme difficulty it supplied not only the requirements of the British armies, but assisted largely in supplying those of our Allies on all fronts. Prior to the war solid tires for heavy vehicles had been almost exclusively supplied by Germany, and British tire manufacturers were, therefore, faced, on the outbreak of war, with the necessity of overcoming the technical difficulties involved in solid tire construction, and that they were successful is demonstrated by the fact that at no time was transport held up through lack of tires.

"During the war practically the whole output of the British tire manufacturers was taken by the Government. This position gave considerable advantage to American competitors, who, until the last year of the war were unfettered in any way by war restrictions and were thus enabled successfully to attack the British home and export trade in motor tires. This export trade of the British manufacturers had been secured at great effort and expense, and war conditions therefore presented American firms with the goodwill of the British tire manufacturers in the various foreign and Colonial markets. American firms who, prior to the war, exported little or nothing are now doing a considerable export trade.

Imports Rise Ten Times

"The tire imports into this country from the United States of America rose from £231,096 (for the year ending 30 June, 1914) to £2,097,215 in the year ending 30 June, 1916, while in the Colonies and eastern markets, where motoring restrictions were less marked, their success was even greater.

"It was only half way through 1917 that their progress in this country was, to some extent, checked by import and shipping restrictions, but the hold secured by the American trade means that their competition has become an after-the-war factor, which presents a very serious menace and a much greater one than any the industry was faced with in pre-war times.

"The Americans have a huge home market which is fully protected by tariffs, while, on the other hand, it is necessary for British manufacturers, with their small home requirements, to be in a position to do a large export trade, and their activities in this direction are seriously curtailed by the advantage gained by the American manufacturers at a time when the whole of the British production was required for war work.

"The rapid rise of the American rubber industry is shown by the fact that in 1914 the production of rubber goods in America was to the value of £60,000,000, and in 1919 this had risen to £240,000,000. About 75 per cent of the total production consists of tires, and, therefore, the approximate value of the output of tires produced during 1919 would be £180,000,000. This export of tires from the United States rose from £788,644 in 1913 to £4,493,316 in 1919, and the export figures available for the current year show values at the rate of £10,000,000 per annum.

Eliminate Special Taxes

"Most of the important American concerns have their own subsidiary British distributing companies, and it is understood the prices at which tires are charged to the branches in this country are so arranged that no profits are shown for income tax purposes or excess profits duty.

"There are now very large stocks of British tires abroad, foreign demands have practically fallen to nil, and British manufacturers are faced with such

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New Japanese Tax Blow to Car Sales

Fees of 1920 Increased 50 to 80 Per Cent—Opposition May Bring Decrease

SEATTLE, May 27—Prospects for the future development of the American trade in motor vehicles in Japan have been dealt a severe blow by the enactment of new prefectural and municipal tax laws on automobiles, motorcycles and motor trucks, which call for excessive fees from owners. Great opposition is developing in Japan to the new taxes and it is hoped that they will be modified.

The new taxes represent an increase of from 50 to 80 per cent on the taxes in force last year. Coming, as it does, at a time of marked business depression in Japan, it cannot fail to have an adverse effect on the automobile business.

On privately owned vehicles of from one to five horsepower the new tax totals a yearly expenditure of 135 yen ($67.50). From five to ten horsepower the total is 229 yen, ($114.50), and from 10 to 15 horsepower, 378 yen ($189).

By far the greater majority of motor cars are rated in the 15-30 horsepower class, and it is in these classes that the taxes are the heaviest. For privately owned vehicles of from 15 to 20 horsepower the tax amounts to 598 yen ($299) per annum, and from 20 to 25 horsepower the very sizable figure of 843 yen ($421).

On the average, the motorist of Japan will be obliged to pay a municipal and prefectural tax aggregating 10 per cent of the first cost of the automobile. The average car of 25 horsepower retails in Tokyo at approximately 8500 yen ($4,250) and the owner of such a car will be assessed for an annual tax of 843 yen, or approximately 10 per cent. The cost of upkeep, including tires, fuel, oil, repairs and garage hire in Japan is very high, and the addition of the new tax will render motoring well-nigh prohibitive, declare Japanese dealers.

The tax on vehicles in commercial use is smaller, but nevertheless very high, taking into consideration the work in which these vehicles are employed. From one to five horsepower, the tax is 70 yen ($35) a year; from five to ten horsepower, 78 yen ($39), and from 10 to 15 horsepower, 127 yen ($63.50).

The new tax is based entirely upon the horsepower rating of the motor vehicle, and does not take into consideration the age of the car, the first cost, or the probable re-sale value.

GERMANY CUTS PRODUCTION

NEW YORK, June 1—German automobile works are suffering a further reduction in demand, according to reports reaching here. Operations have been cut to a minimum as they have in many of the Rhenan-Westphalia iron works.

Industry Steady as Market Changes

Financing Export Sales to Help Crop Regions—Falling Market to Continue

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upon a moderate scale, provided long-term credits can be extended. This is a pre-requisite to foreign trade. Sales of goods abroad inevitably will relieve depression at home. Those companies which have cultivated foreign customers carefully and wisely soon will begin to reap the harvest of their forethought.

Arrangements are now being made for financing export sales of foodstuffs, cotton and other commodities. This will thaw out frozen credits in the South, Middle West and Northwest, thereby putting into circulation money which can be used to buy finished products. The emergency tariff, framed especially for the benefit of the farmer, probably will tend to slow up exports, but its full effect in this direction cannot be determined immediately. It is not likely its deterrent effects will be strong enough to prevent a steady increase in exports.

Haphazard sales efforts are no more advisable in foreign trade than they are at home, and the companies which study their markets carefully will get the most business. Advices from Argentina, for example, state that the large surplus stocks of automobiles in that country are being gradually liquidated and it is probable dealers will be in the market again by late fall. The same conditions undoubtedly prevail in other countries. On the other hand, there is little hope of any extensive business with England for months to come, although some of its colonial possessions are well worth cultivating.

The United States as a nation is comparatively young industrially and it has not become inured to hardships and adversity as have some of its older sisters. For that reason it is rather temperamental. It either is riding joyously on a high tide of prosperity or it is in the slough of despond. There apparently is no mental middle ground. Times are hard now, largely by contrast with the unexampled prosperity of the war period. An enormous amount of business still is being done and the present volume of employment would not have caused serious alarm in the years prior to 1914.

Deflation Hopes Ill Founded

Any hope that recovery from war inflation would be rapid was ill-founded. It is vastly easier to spend money than to save it, and it takes much less time to burn up capital than to build it. Some of the wealth destroyed in the war must be restored before there can be any real progress toward what may be considered normal conditions. This applies not only to this country but to every nation in the world.

For that simple economic reason the process of recovery will be painfully slow and it will be attended with many difficulties. The business structure of the country is gathering strength, and the gains from now on never will be quite offset by the losses, so that recovery is assured.

Business will be done on a falling market for many months to come and its stabilization will be marked by a survival of the fittest. Falling markets do not necessarily mean hard times, however, and faith in the future will be abundantly rewarded. A long period of prosperity is before the United States and there is every indication that it is approaching with all the speed that can be expected under the circumstances.

Blame Backward Spring for Sales Resistance

MILWAUKEE, May 31—Shipping instructions from distributors and dealers have assumed a more satisfactory volume, with the result that the recent accumulation of finished jobs in factory warehouses is steadily being eliminated. The operation of factories is expected to resume an upward swing momentarily. From the middle of the month to date nearly every passenger car manufacturer felt the effect of a sudden recurrence of sales resistance due principally to the backward spring, which jammed the flow of cars from producer to dealer. The arrival of seasonable temperature, however, has loosened the congestion.

The automotive parts and equipment industry in Milwaukee did not slow up to nearly the same extent as passenger car production, although some plants have noticed a tendency on the part of manufacturers to cut down delivery specifications on contracts for engines, frames, axles, etc., because smaller quantities were required currently. No perceptible reduction of working forces in parts shops has been made, although production schedules were curtailed to some extent to prevent undue accumulation at the source.

COTTON ACREAGE REDUCED

NEW YORK, June 1—Reductions in cotton acreage for 1921, together with a reduction in use of commercial fertilizer, give an estimated yield of 7,558,-365 bales for 1921, according to American Cotton Association figures. This yield is still further reduced to 6,762,664 bales by allowances for abandoned acreage after planting and other minor losses. The average production for the past five years has been 11,808,389 bales. The acreage for the current year will total approximately 24,563,486, conforming very closely to the acreage planted in 1897, which totaled 24,319,584.

WILLYS LIGHT JUNIOR, $295

TOLEDO, June 1—The Willys light division of the Electric Auto-Lite Corp. is now manufacturing a small individual lighting plant for use on farms, which will be known as the Willys Light Junior. The new plant, which sells for $295, has a generator rating of 500 watts.

Chicago Bank Finds Lower Prices Needed

Process of Liquidating Inventories at High Costs Slow and Difficult

CHICAGO, June 1—While general manufacturing shows little change in the past thirty days in the Middle West section, the disposition of manufacturers being to operate on a hand to mouth basis, buying only those materials that are necessary to fill outstanding orders, there are evidences of a gradual stabilization of business conditions.

The Federal Reserve Bank of Chicago finds that "business is going through a process of 'backing and filling' as a result of the effort to liquidate stocks purchased at higher prices, and to replenish at the new market level lines of merchandise as they are exhausted."

The advent of warm weather has gone a far way toward changing the mental attitude of the farmer although the farm implement business still remains practically at a standstill. One of the large implement manufacturers has closed down virtually all of its plants; another is operating on a schedule about 35 per cent of last year and nearly all implement manufacturers have a sufficient stock of finished products on hand to meet the ordinary demand for some months in the future.

In the manufacturing centers trade continues in a surprisingly good volume with indications of a movement of merchandise in those centers where industries experienced a sharp slump around the end of the year. Collections show no uniformity, the situation seeming to turn upon the ability of business men to liquidate their inventories.

Lowering of the cost of labor and a tendency to greater efficiency are showing themselves in some of the larger cities of this section. One outstanding feature in the motor car industry, as in other lines of business, is that those who are showing courage in the conduct of their business by forging ahead and manufacturing or using up high priced materials on hand and replenishing at lower costs are finding a ready market for their products, even though it be at reduced prices; while those who have adopted a more conservative policy of manufacturing are necessarily liquidating their inventories more slowly, and consequently are experiencing more difficulty in working out of the condition in which they found themselves.

Used Car Market Limited

A factor from the dealers' standpoint is that there is a more limited market for used cars, due to unemployment and general depression. Accordingly, the dealer finds his capital tied up in these cars and is unable to make further sales, involving trade, until he has liquidated such stock. Many of the steel contracts to automobile companies contain adjustment clauses.

War Gave America World's Tire Trade

British Market Now Using 75 Per Cent Imports—Would Apply Equalizing Duty

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competition from Continental manufacturers as will necessitate the liquidation of stocks at a loss in very many cases and the closure, in due course, of such markets in Italy, France, etc.

"If the import of tires at the present rate continues they will cover 75 per cent of the total motor tire requirements of the British home market.

"In addition to the disadvantage of the currency rates the British manufacturer also suffers from the cost of his product being increased by the heavy duty on imports of tires into foreign countries. In the Canadian and American markets, where the exchange rates favor the British, it is impossible for them to take advantage of the position as in those countries a different type of motor pneumatic tire came into general use during the war, and it has not yet been possible for the British manufacturers to obtain the necessary plant to enable them to meet the demand for this type of tire owing to war restrictions.

"The following remedies are suggested for consideration:

"(a) The limitation of future imports and the treatment of foreign stocks on hand in England as 'future' imports.

"(b) The levy of a duty on future imports on the basis of the difference between wages and local expenses per article in the country of origin at the rate of exchange current from time to time and the wages and local expenses per article of the British manufacturer.

"(c) The influencing of British Dominions to investigate and confirm whether British manufacturers actually have a tariff preference over foreign manufacturers in view of the depreciation of the various currencies, and, where necessary, the adjustment of such tariffs."

Tire Cuts in Belgium Check American Sales

NEW YORK, June 1—American tire trade in Belgium has been severely affected by an unprecedented wave of price cutting entered into by many of the leading domestic manufacturers and producers in England and on the Continent. The price cut has been so extensive that one of the large American companies has recalled its agent, being unable to compete successfully under the new conditions.

The questions of credits and exchange rates have also been important factors in the problems affecting American manufacturers. Opposed to the American policy of demanding cash in advance or payment against documents is the long term credit offered by German makers and now adopted by at least one important French company. To get business in Belgium it is borne to American manufacturers that they must make every effort to meet European competition with more acceptable terms.

Good business is reported in some American brands which are being offered at prices in francs near the European level. Buyers of low price tires do not lay stress on mileage as long as the price is what they think they should pay.

MAY SALES FALL OFF; JUNE OUTLOOK DULL

NEW YORK, May 31—Automobile production for the month of May reached approximately the same figure as in April but there was a material falling off in sales in practically every section of the country.

The most notable exception was in the South where business showed an improvement for the first time in many months. This was due to gradual liquidation of the cotton crop in preparation for the sale of the new crop.

Retail business in New York and the metropolitan district remained fairly steady and approximated that for April.

Reports from the great agricultural sections show that while business in May was not as good as in April a marked improvement in sales is expected when harvesting of the crops begins.

Nearly every section of the country reports that lines which have cut prices are doing a good business and that there is every indication sales will continue brisk.

General indications are that both production and sales in June will be considerably below May. The cry of dealers everywhere is for price stabilization by definite announcements by manufacturers of what they intend to do.

AJAX BUILDS NEW TIRE

NEW YORK, May 27—Following its reduction in prices which became effective two weeks ago, the Ajax Rubber Co., Inc., is soon to bring out a new cord tire developed by William W. McMahan. The new tire is now in production at the factories in Trenton, N. J., and will be placed on the market at once.

SHERIDAN SALES UNCHANGED

REDWOOD CITY, CAL., May 27—Capt. Eddie Rickenbacker, who is here to-day supervising the preparation of the army field for his flight to Washington to-morrow morning, stated that the purchase of the Sheridan Motor Car Co. by the Durant interests would not affect the Sheridan on the Pacific Coast and he would continue active management.

Steel Tread Tires Pass Out in France

Surplus Army Stocks Factor in Swerving Former Demand—Clincher Type Favorite

PARIS, May 14 (By Mail)—Steel studded automobile tires, which only a few years ago were considered absolutely essential for safety, are rapidly passing out of use in France. It was formerly common practice to run with steel studded tires on one rear wheel and the opposite front wheel, under the impression that this combination alone gave a guarantee against skidding. In London, taxicabs are bound by law to be equipped in this way, and although there was no such legal obligation in France, the practice was generally followed by owners. Customers taking delivery of a new car claimed at least one steel studded tread.

The general practice now is to supply all new cars with rubber tread tires, the public accepting these without objection. This change is bringing France into line with American practice, with the difference, however, that non-skid chains are never used by French motorists. Michelin reports that his production of steel studded tires is 60 per cent less than before the war. Pirelli declares that he is now selling 40 per cent fewer steel studded tires than was the case two years ago. At the French factory of the Goodrich Tire Co. the production of steel studded tires, which represented 25 per cent of the total output, has been stopped altogether, owing to lack of demand.

Several causes seem to have contributed toward this rapid abandonment of the steel studded pneumatic tire. The American Army in France set an example of running its automobiles on all-rubber tread tires, which seems to have impressed French motorists. In addition, large stocks of these tires were left behind by the army and were sold when other types were almost impossible to obtain, thus initiating motorists to their use and giving them confidence in running on rubber treads.

Michelin Brings Out Cord

Michelin is also largely responsible for the change, for since the armistice he has brought out and featured a cord tire which of course has an all-rubber tread. As Michelin has by far the biggest output in France and equips at least 60 per cent of new French cars with tires his adoption of cord construction and rubber treads had an important influence.

The Goodrich company, which also has put a cord tire on the market, considers that the steel studded tread was often used because of the protection it afforded against punctures, and now that the same protection is afforded by cord construction, with longer life and lower cost, there is less reason for the use of the steel studded band. A contributory cause, it is pointed out, is the high cost

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Indiana Road Work Waits Lower Prices

Policy of Prohibiting Necessary Construction Rouses Opposition of Industry

INDIANAPOLIS, May 27—Last week Governor McCray announced simultaneously the names to complete the reorganization of the State highway commission and a new policy of the commission—not to permit construction of highways in Indiana "until prices come down."

Organized units of the automotive industry are preparing for a session with the State highway commission. The automotive organizations hold that the commission policy should not prohibit improvement where necessary for improvement of traffic conditions.

Apparently the whole political framework of the present administration which took office Jan. 1 is directed toward suspension of highway extension. The State tax board, which has authority over highway and other bond issues, announced a few days ago "that the taxpayers have an opportunity of preventing unnecessary expense" by appealing to the tax commissioners. The last legislature passed an administration measure providing that where bonds carry more than 5 per cent interest and amount to more than $5000, the whole question must be referred to the State tax commission. Two road bond issues, one from Bush County and one from Marshall County, for permanent improvement of dirt roads were disapproved by the tax commissioners last week, killing both projects. Such a settled highway policy is arousing the automotive industry of the State.

Pershing an Advocate of Highway Commission

WASHINGTON, May 28 — Another method of financing highway construction throughout the country has been advocated by E. J. Adams, former member of Oregon State Highway Commission and now Secretary to Senator Stanford of Oregon, when he appeared before the Senate Committee on Postoffices and Postroads in support of the proposed Townsend bill. He suggested that Congress authorize the issuance of bonds without interest which will also be legal tender for domestic obligations. He contended that this method would provide a market for bonds because Congress could authorize receipt for bonds on deposit, making them serial bonds payable over a period of years.

In support of his plans, he asserted that state highways and county roadways built nearly all after the issuance of bonds. These bonds must have a market, he said, and the market is so congested at present that they cannot be sold. The Committee appeared quite interested in his plan and questioned him as to the costs of highways. He estimated that it would cost $15,000,000,000 to build essential highways without consideration of maintenance costs.

General Pershing appeared on the stand today and advocated a central body, such as proposed in the Townsend bill, to direct Federal expenditures for road purposes. The General discussed highway legislation only in a general way. He stated that all roads were valuable and it was necessary at all times to get farm products to shipping points as well as to the army.

Representatives of the Federal Highway Council, organized farmers and others interested in highways appeared before the Committee this week. Senator Townsend expects to conclude the testimony by June and report the bill out for consideration at the special session.

N. A. C. C. to Distribute 500 Prizes for Essays

NEW YORK, June 1—Five hundred prizes for the best essays on safety are offered to the grammar school pupils of the United States by the National Automobile Chamber of Commerce. The contest is under the direction of the Highway and Highway Transport Education Committee, a group of men from United States Government departments and other associations interested in motor transport and highways.

The essays are to be written in the fall term so that children may have ample opportunity for observation and study of traffic dangers during the vacation months. Teachers in every municipality in the country will have full details concerning the contest at the opening of the 1921-22 term which they will be asked to detail to the children.

A trip to Washington, D. C., and a gold watch will be first prize. The second national prize will be a gold loving cup, and the third, a silver loving cup. In addition to these, medals and cash prizes will be distributed in all states, territories and possessions of the United States. The Highway and Highway Transport Education Committee directing the contest is headed by the United States Commissioner of Education and includes experts on highway work.

FARMERS DISCUSS UNIT BUYING

INDIANAPOLIS, May 31—Co-operative buying and pooling of motor equipment were two subjects discussed by the purchasing agents of farmers' associations of Indiana and neighboring States, who met here Tuesday and today. O. J. Stierwalt of the Ohio Farmers' Commercial Service and W. H. Wagenbreth of the Missouri Farm Bureau were the principal speakers. Some of the "doctrines" advocated by these speakers would make the purchasing bureaus of farmer organizations huge distributing centers for vehicles, implements, etc. It was plainly intimated that one large manufacturer would readily make contracts with the farm bureaus, allowing substantial discounts for exclusive markets.

Oregon Gets Results in Highway Program

Co-operation of Counties Links State With Main Routes on Coast

PORTLAND, ORE., May 31—The thirty-five counties of the State of Oregon have bonded themselves to the extent of $15,363,704 for road improvement since the advent of the automobile, practically all of the money being voted within the last three years, and considerably more than half of it still remaining unspent, according to a summary made public this week by the State Highway Commission. This is in addition to the State road money and the Federal aid money which has been provided along with county funds.

Under the Oregon system the State Highway Department stands ready to aid the various counties by putting up half the cost for improvement of the main highways. This liberal program has resulted in activity in the various counties, both in meeting the State funds for improvement of main highways and for secondary roads connecting with the main highways.

While no summary is made, it is estimated that at least half of the money obtained from county bond issues, which has been spent thus far, has gone, together with State funds, into improvement of three important roads, the Pacific highway, running north and south, and connecting with California; the Columbia River highway, the great east and west road, and the Old Oregon Trail, which connects with the Lincoln highway from the east.

Oregon is to have a second main highway into California, according to action of the State Highway Department this week in permanently establishing the location for The Dalles-California highway. The highway, which has been recognized for some time as one of the important State roads, but had not been located with a view to permanent improvement, begins at The Dalles, on the Columbia River, and runs southward through central Oregon into California. The road will be an inland route as compared with the Pacific highway, which is a coast route. Near the Oregon-California line the new highway will swing westward, joining the Pacific highway in northern California and affording an immense loop for travelers from Portland to California and return.

Locate First of New System

Location of the first 100 miles of this road, from The Dalles south, was made by the highway commission last week, and it is estimated that $1,500,000 will be required to grade the road and surface it with gravel. Work will start in 1922 and it will take several years to complete the road. In the meantime the present roads, which are narrow and have some severe grades, will be used by those desiring to make the trip to California by the eastern route.

W. R. Wilson Named Maxwell President

New Executive Was Formerly with Dodge and Studebaker—Takes Office June 15

NEW YORK, June 2—The election of William Robert Wilson as president of the Maxwell Motor Corp. was announced here to-day by Walter P. Chrysler following a meeting of the Maxwell board of directors and the reorganization committee of the company. Wilson has been a vice-president of the Irving National Bank and will sever this connection at once to assume his duties with Maxwell on June 15.

In announcing Wilson's election, Chrysler said, "I consider Mr. Wilson one of the strongest executives in the automobile business."

Wilson's introduction into the field of automobile manufacturing was with Studebaker, where he began as assistant to the manufacturing manager and rose to assistant to the general manager. On Dec. 1, 1913, he went with Dodge Brothers, where he remained five years, and then resigned to accept the vice-presidency of the Irving Bank.

In his connection with the Dodge brothers he was directly associated in the organization of their motor car business. He was credited with considerable of the responsibility for the selection of their organization and the upbuilding of their departments, whether pertaining to manufacturing, distribution or commercial phases of the work.

When he takes office Wilson will be one of the youngest executives in the industry. He is a graduate of the Armour Institute of Technology, where he received the M. E. degree in 1909.

Announcement was made by AUTOMOTIVE INDUSTRIES on Feb. 15 that the selection of Wilson was being considered by Chrysler and the reorganization committee. It was deemed advisable, however, to defer the formal announcement until transfer of the Maxwell and Chalmers properties to the new company was well under way.

Directors of Company Elected

Directors of the company elected were Walter P. Chrysler, chairman of the board; Fred T. Murphy, J. R. Harbeck, James C. Brady, C. C. Jenks, Harry Bronner, William Robert Wilson, Elton Parks, J. S. Bache, E. R. Tinker, Henry Sanderson, Carll Tucker, Allen F. Edwards, Thomas F. Dougherty and T. C. P. Martin.

Officers elected in addition to President Wilson are W. Ledyard Mitchell, Carll Tucker and A. B. Barker, vice-presidents; T. H. Thomas, controller, and Jackson B. Clark, E. W. Clark, L. W. Linaweaver and Horace Davies, assistant secretaries.

The executive committee of the company is Walter P. Chrysler, Elton Parks, Fred T. Murphy, Allen F. Edwards, Harry Bronner and C. C. Jenks.

Dealers Flood Congress with Dumping Protests

WASHINGTON, June 1—Automobile dealers throughout the country are flooding Congress with protests against the reimportation of American-made trucks. The movement is not confined to the Atlantic and Pacific seaboards where sales have been heaviest, but has extended to small communities in the Middle West. For instance, the Motor Trade Association of Riley County, Kansas, adopted a resolution urging Congress to enact legislation to prevent dumping of salvaged material from European war areas in competition with American industry. All of these protests have been filed with the Senate Committee on Finance.

The protests are rather late to bring effective action, for the anti-dumping bill has passed Congress and has been signed by the President. It was understood that its provisions might offer some relief from the reimportation menace, but persons who have studied it carefully contend that before a tax can be imposed on the difference between the exporter's sale price and the foreign market value, price discrimination against this country must be shown. It might be possible for a customs appraiser to hold up a shipment pending investigation, but as it stands now there is little prospect for real relief under the existing law.

Miller Encourages Loans on Car Paper

(*Continued from page* 1176)

ally toward borrowers, as against their attitude a year ago. Bankers are far more conservative now; they are improving their position and have plenty of excuses of their own for declining a loan, without having to fall back on the old excuse that the Federal Reserve Bank will not rediscount the paper.

Further, the motor car dealers and distributors are, it is said, in no frame of mind to take on obligations, and stocks with cars and accessories. It seems perfectly safe to offer large credit facilities, since only a small part of the facilities are likely to be asked for.

The manufacturers may want this credit, to assist toward larger production—but so far as possible the Kansas City financial resources will be conserved to care for the distributors of this district, to be available for them after factory production has prepared the supply for them.

Altogether, the announcement of Governor Miller regarding rediscounting of automotive paper, is the keynote in the portrayal of improving conditions.

FRED W. MORGAN DIES

CHICAGO, May 27—Fred W. Morgan, founder of the firm of Morgan & Wright, bicycle tire manufacturers, died at his home here yesterday of angina pectoris. Mr. Morgan was born in New York, March 30, 1854.

Seiberling Buys Newcastle Rubber

Secretary Acts as Representative —Sale Price $103,000—Held Controlling Interest

AKRON, May 28—The Newcastle Rubber Co. at New Castle, Pa., was purchased at receiver's sale yesterday by R. C. Ellsworth of Akron, who served as private secretary to former President F. A. Seiberling of the Goodyear company. Ellsworth, it is reported, bid in the plant as representative of Seiberling. Seiberling attended the sale. The plant is valued at over $500,000. The sale price was $103,500.

F. A. Seiberling is reported to have held a controlling interest in the Newcastle Rubber Co. for some time, having originally purchased the plant more than a year ago for one of his sons who since has been forced to go West for his health. Through Seiberling's financial difficulties at Goodyear, the Newcastle plant became involved and was placed in the hands of trustees. Seiberling reported that the purchase of the plant through Ellsworth does not mean that he will again become actively engaged in the rubber industry, for it is known that he has other definite plans in process of development at this time. The Newcastle plant includes two large and fully equipped factory buildings, seven and one-half acres of ground, an office building and three dwellings.

Americans Sweep Indianapolis Race

(*Continued from page* 1176)

dangerous possibilities but both escaped as well as their mechanics.

Broken water connections on the Talbot, Sunbeam and one of the Frontenacs accounted for the elimination of these cars. Where these broken connections were located technical committee reports do not make clear. Probably water pump trouble accounted for most of them.

A rather peculiar condition accounted for the elimination of Pete Henderson's Junior Special. Freezing brakes caused the wheels to skid and resulted in the car swinging into the side wall.

Joe Boyer's Duesenberg had to be pushed into the pits and withdrawn after he had driven a very pretty race and in fact had pushed De Palma very hard during the first few laps, winning the sixth. His trouble was a broken axle shaft.

A consistent race was driven by the winner. He stopped on the 77th lap for two front tires and again was flagged by his pits to come in for gas and oil on the 160th lap.

A great amount of interest was created in the Frontenac driven by Tom Alley. This was fitted with Disteel wheels and was able to carry for this reason 10 lb. additional air pressure in the tires. This car ran well, being for a large part of the race in third place and gaining on the leaders.

Many Price Reductions Announced

Quick Price Action Urged by N. A. D. A.

Stability of Market for Cars Threatened by Indecision, Declare Dealers

ST. LOUIS, May 31—In an effort to end the present unsettled condition in sales, due to continued drops in price, General Manager Harry G. Moock of the National Automobile Dealers' Association to-night wired all manufacturers of motor cars, asking them to make any contemplated reductions at once.

The appeal was prompted by a flood of letters and telegrams from dealers all over the country, urging the N. A. D. A. to do anything within its power to bring the present condition to an end. Reports from all sections state that each successive price reduction puts an additional damper on general buying of cars and indications are that if the reductions are spread over the summer the season's business will be ruined. Leading dealers, however, feel that there can be a good business this summer if the price question can be disposed of at once.

General Counsel C. A. Vane of the N. A. D. A. conferred this week in New York with General Manager Alfred Reeves of the N. A. C. C., which conference developed that the manufacturers as an organization do not care to discuss prices. With legal opinion closing this avenue of appeal the only remaining course was a request by the N. A. D. A. to each car maker individually. The telegram follows:

"Dealers all over the United States have been wiring here, asking National Automobile Dealers' Association to lend its help to stabilize the present price situation. They complain the public is refusing to buy any merchandise because of uncertainty of future prices of automobiles. May we on their behalf ask you to announce immediately whether your factory will make price reduction or adhere to present prices for a definite period. The question is not so much one of price as of stabilization. For that reason we believe an immediate declaration should be made by each manufacturer as to what his policy is going to be if we are going to reestablish a buying market."

Federal and Oldsmobile to Hold Present Prices

DETROIT, May 28—Federal Motor Truck Co. sent out a letter this week guaranteeing prices on Federal trucks to Oct. 1. The notice which was sent out by W. C. Rowley says while there has been some slight reduction in the price of steel recently, the cost of manufacture has not been affected thereby.

Olds Motor Works also has notified distributors that there will be no price reduction in the Oldsmobile line. The letter points to the introduction last December of the new four-cylinder model and says the factory could not have produced this car at this time were it not for the fact prices had been predicated on a later drop in the price of material and labor and a certainty of volume production.

Lafayette Prices Cut Ranging $750 to $950

INDIANAPOLIS, June 1—Price reductions ranging from $750 to $950, effective to-day, are announced by the Lafayette Motors Co. Prices are f.o.b. Indianapolis, including standard equipment. The new prices are: Touring car $4,850, reduced $775; roadster $4,850, reduced $775; four-door coupe $6,250, reduced $950; sedan $6,500, reduced $900; limousine $6,750, reduced $750.

LINCOLN DOWN $300 TO $800

DETROIT, June 1—Price reductions have been made effective to-day by the Lincoln Motor Co. The new prices are: Open models $4,300, reduced $300; coupe $4,950, reduced $800; sedan $5,400, reduced $600; limousine and town car $6,000, reduced $600.

HAYNES GUARANTEES TO 1922

KOKOMO, IND., June 1—Prices on Haynes cars will be guaranteed to Jan. 1, 1922, it has been officially announced by Alton G. Seiberling, president of the Haynes Automobile Co. "Our present margin of profit is so slight," he declared, "that it would be impossible for us to reduce prices."

HANDLEY GUARANTEES PRICES

KALAMAZOO, MICH., June 1—The Handley-Knight Co. has notified its distributers that their prices are guaranteed up to Jan. 1 next. The statement says the lowest prices possible to be maintained were fixed last November and were $500 less than were justified by conditions at that time.

RECEIVER TO SELL BODY PLANT

DETROIT, June 1—The property of the Detroit Weatherproof Body Corp. at Corunna, Mich., will be sold at public auction June 17 by the Security Trust Co. of this city as receiver.

HUDSON-ESSEX DOWN $150

DETROIT, June 2—Price cuts of $150, effective to-day, are announced on all models of Hudson and Essex cars.

Nash on Half Time as Sales Fall Off

Production Cut to 65 Daily Pending Developments—Price Cuts Harmful

KENOSHA, WIS., May 28—Following reduction of working schedules by the Nash Motors Co. of Kenosha, Wis., to a basis of a full half-day six days a week, due to over production, certain departments have been shut down temporarily pending improvement in the demand for cars. A statement by President Charles W. Nash says in part:

"Automobiles take up when finished an unusual amount of storage space, and the operation of an automobile factory, insofar as the completed car is concerned, is controlled almost entirely by the demand for the product. In other words, if orders suddenly cease to come in, we can run but a short space of time due to the fact that we have not the storage room. It means a severe loss to shut down a plant and allow the organization to scatter, and if for no other reason than this we do our best to run continuously.

"We decided last week that it would be better to operate a full half-day each day and make 65 cars in the half-day than it would be to try to carry this over a full day's work, due to the fact that it would be necessary to have reduced our working force materially if we attempted to operate all day; whereas if we operate a half-day we are able to keep a great many more employed.

"We have no definite date fixed when we may be compelled to close down for a short while entirely. This will be due to the condition of the business throughout the country. Our dealer body had a considerable number of cars on hand, and the extreme cold, backward weather that we have been having all spring is not conducive to selling automobiles.

"Another thing: Some companies have been able to reduce their prices materially, and this has upset in a measure the prospective buyers of Nash cars. My judgment is that if we should get some settled, warm weather, selling would take a new lease on life and business would go on to a considerable extent. However, it is impossible to tell exactly what the attitude of the public is going to be."

SHERIDAN PRICES DOWN

MUNCIE, IND., June 1—The Sheridan Motor Car Co., which went into the control of W. C. Durant last week, has cut its prices. The roadster and touring car now sell at $1485, a cut of $200; the coupé at $2265, a cut of $300, and the sedan at $2765, a cut of $300.

Cars in All Price Classes Are Cut

Studebaker Prices Down $150 to $200

Light Roadster Added to Line to Sell at $1300—Twelve Cars Reduced

NEW YORK, June 1—Price revisions covering its entire line and ranging from $150 to $200 were made by the Studebaker Corp. to-day, the new prices to take effect at once. In making the price cuts the company announces a new EJ-40 model roadster to sell at $1,300. The new and former prices follow:

	New Price	Former Price
Model EJ-40		
Roadster	$1300	New model
Special body roadster	1695	$1850
5-passenger	1335	1485
Sedan	1995	2150
Model EH-50		
Roadster	1585	1750
5-passenger	1635	1750
4-passenger	1635	1750
Coupe	2450	2650
Sedan	2550	2750
Model EG-60		
7-passenger	1985	2150
Coupe	2850	3050
Sedan	2950	3150

President Erskine of the Studebaker Corp. has announced that April sales numbered 6589 cars, as compared with 2602 of April, 1920, while May sales were 7400 against 4024 for the same month last year. Unfilled orders approximate 7000 cars. May collections exceeded $12,000,000. Profits for this quarter are expected to exceed $5,000,000 before taxes.

CHALMERS PRICES DROP

DETROIT, May 27—The following price reduction was announced by General Sales Manager A. E. Barker on Chalmers cars: 5-passenger touring, from $1,795 to $1,545; roadster, $1,795 to $1,495; 7-passenger touring, $1,945 to $1,795; 5-passenger sport, $1,995 to $1,695; coupé, $2,595 to $2,295; sedan, $2,745 to $2,445. All prices f.o.b. Detroit.

CHEVROLET CUTS ITS "FB" LINE

NEW YORK, June 1—Following its recent action in reducing the prices on its "490" line, the Chevrolet Motor Co. has cut the prices of its "FB" line. The touring car has been reduced to $1,185 from $1,345, the roadster to $1,185 from $1,320, and the sedan and coupe to $1,885 from $2,075. The prices are f.o.b. Flint.

KING TO BUIILD NEW COUPE

DETROIT, May 31—King Motor Car Co. will put a new King 8 coupe on the market with deliveries about August 1. Announcement of the new member of the King family was made by President Weber in a letter to the trade this week. The only reference to price is the statement in the letter that above everything else in the automobile to-day it must be built to meet "to-day's pocketbook."

Buick Cuts Prices Ranging $300-$660

FLINT, June 1—Price reductions on the Buick ranging from $300 to $660 went into effect to-day. Simultaneously with the reductions the Buick line assumes the serial number "1922" instead of "1921" which expired May 31. It was announced that present models will be carried through the 1922 season.

Old and new prices are as follows:

		Old Price	New Price
1922-44	Roadster	$1795	$1495
1922-45	5-passenger	1795	1525
1922-46	3-passenger	2585	2135
1922-47	5-pass. Sedan	2895	2435
1922-48	4-pass. Coupe	2985	2325
1922-49	7-pass. Touring	2065	1735
1922-50	7-pass. Sedan	3295	2635

Buick guaranteed prices to the public to May and to dealers to July 1 on the 1921 models. The guarantees are not applicable to cars bearing the 1922 serial numbers.

SENECA REDUCES PRICES

FOSTORIA, OHIO, June 2—The Seneca Motor Car Co. has reduced the prices of its two and five passenger touring cars from $1185 to $1045 and of its truck from $1160 to $1020.

TEMPLAR MAKES BIG CUT

CLEVELAND, June 2—Price reductions of $500 on open models and $600 on closed models, effective July 1, are announced by the Templar Motors Co. The two, four and five passenger touring cars have been reduced from $2885 to $2385 and the sedan and coupé from $3785 to $3185. Prices are f.o.b. Cleveland.

FRANK H. WHEELER DIES

INDIANAPOLIS, May 28 — Frank H. Wheeler, 57 years old, Indianapolis millionaire, committed suicide yesterday morning by discharging the contents of both barrels of a shotgun into the left side of his head. Mr. Wheeler was one of the founders of the Indianapolis Speedway, president of the Wheeler-Schebler Carburetor Co., and was connected with the Stutz Fire Engine Co., being vice-president, and was president of the Wheeler-Langsenkamp Brass Co. It is believed his action was due to despondency over the condition of his health and also brooding over the death of Seymour Avery, an associate.

Franklin Makes New Revision in Prices

New List Approximates Scale Fixed in September Reductions of 1920

SYRACUSE, June 1—Franklin announced to-day price reductions on open cars ranging from $150 to $200 and on inclosed cars from $200 to $250, effective immediately. The reductions follow a small increase on the Franklin line made March 1, which in turn had been preceded by an increase of $100 Jan. 1 coincident with the appearance of the new hood.

The present reductions bring Franklin prices within $50 to $150 of the low level of September, 1920, when Franklin, following close on the heels of Ford, was the second manufacturer to announce a substantial post-war price cut. Franklin prices are now $400 to $750 below the high war-time levels.

A comparative summary of Franklin prices follows:

	New Price	March 1921	Sept. 1920	High war-time
Touring	$2,650	$2,800	$2,600	$3,100
Runabout	2,550	2,700	2,400	3,050
Roadster	2,550	2,750	2,500	3,100
Sedan	3,650	3,850	3,600	4,350
Brougham	3,550	3,800	3,500	4,300
Demi-coupe	2,850	2,950	2,750	3,300
Demi-sedan	3,050	3,150	(New Type)	(New Type)
Chassis	2,225	2,300	2,225	2,625

"Wages are not being cut," H. H. Franklin declared. "With our price cut last fall sales started on the upgrade, and from month to month during the early winter season held very near to factory capacity. Since December we have not had on hand at the factory on any one day more than three days' production of cars, and right now our dealers' stocks are lowest of the year.

"Reduction in the price of Franklin cars is being made without any reduction in wages. We hope that the new basis will permit the continuation of the present working force, without the contractions that are usually expected in the automobile industry in the midsummer months. Our previous price adjustment also left wages unaffected and was accompanied by a slight increase in employment."

ELGIN PRICES REDUCED

ARGO, ILL., June 1—The Elgin Motor Car Corp. announces price reductions ranging from $180 to $300, effective tomorrow. The price of the touring car has been cut from $1775 to $1595; the sedan and coupé from $2795 to $2495.

Death of Batchelder Shock to Motordom

First Became Roads Enthusiast in Bicycle Days—Tragedy Ends Noted Career

NEW YORK, June 1—A pall of grief has been cast over the entire industry by the tragic death of Amos G. Batchelder in the airplane disaster near Morgantown, Md., which cost seven lives. The universal esteem in which he was held was evidenced at his funeral to-day.

Every branch of the automobile industry in this country and abroad had representatives at the funeral. Floral tributes were received from the National Automobile Dealers Association, Motor Union of Great Britain, and from every automobile and aero club in this country and Canada. Representatives of these organizations and the Department of the Interior, Bureau of Public Roads, Chamber of Commerce of the United States, Brigadier General Mitchell of the U. S. Air Service, National Geographic Society, Aero Club of America and five past presidents of the A. A. A. were present.

Services were conducted by Rev. Ulysses G. B. Pierce, rector of All Souls Unitarian Church. Among the floral offerings was an attractive piece from the Oldtimers, an organization of automobile pioneers. Batchelder became associated with this organization during his five years' service as an editor for the Class Journal Co. He has been executive chairman of the A. A. A. for eleven consecutive years and was re-elected recently for a term of four years.

The body was taken to Buffalo where it will remain in a vault until fall and then be interred in the family plot at Attica, N. Y.

Hundreds of messages of condolence have been received by Mrs. Batchelder, who was visiting relatives in Jackson, Mich., when she received word of her husband's death.

Popular in Washington

Probably no man in the history of the automobile has been better loved than Batchelder and few have done more than he for the motor vehicle. As executive chairman of the American Automobile Association he was known personally to thousands of motorists in every section of the country, and they were fully appreciative of his ceaseless efforts to promote better highways. In no circle, however, was Batchelder more popular than in official Washington. He had stood high in the esteem of several administrations and his views on highways always commanded respect.

Back in the days of the bicycle, when most people looked upon any proposal to build roads as only another means of burdening them with taxes, Batchelder foresaw their need and their value, and he was first to recognize the importance of bringing the Federal government into highway building. When President Wilson signed the Federal Aid Road Act on July 11, 1916, thereby bringing the Government into road building after more than 75 years of a passive attitude toward highways, Batchelder all but collapsed. He had reached the goal of many years of effort and did not realize until then his weariness from the strain he had been under.

Batchelder had very clear and definite ideas on highway legislation and road building, and he lived to see his ideas generally accepted. He talked good roads incessantly, in season and out, to everyone he met, because he believed everyone should share his enthusiasm and that by incessantly talking good roads he would win more good roads advocates. He had traveled many thousands of miles into every part of the United States to speak on his favorite topic. He was to have delivered addresses on this theme in Salt Lake City, June 16 and 17. He had been one of the foremost advocates of the Townsend bill.

Never Too Tired to Boost

In spite of numberless obstacles, Batchelder never became discouraged. He never was too ill or too tired to travel to any point of the United States where he might be needed to bolster up a slipping bond issue for highway building. To him more than to any other one man the motorists of the United States owe a debt of gratitude for the charting, sign marking and improvement of the roads they use.

While promotion of highway legislation, building and maintenance always has been a large part of the work of the A. A. A., Batchelder gave generously of his own time and money to the cause in the serene belief that his work in this direction was a service to the country.

(*Continued on page* 1190)

BATCHELDER A POWER IN CAR DEVELOPMENT

NEW YORK, June 1—This tribute is paid to A. G. Batchelder by James Rood Doolittle in his "Romance of the Automobile Industry":

"A. G. Batchelder, chairman of the executive committee, is the commander in the field of all the armies of Three A's. He presides at the councils and for years has had more influence with the various administrations than anyone else. He edits and manages The American Motorist and, ex-officio, has a hand in nearly every activity of the organization. Mr. Batchelder was a newspaperman of prominence before entering the automobile field, and during the past ten years has developed qualities of much importance to motordom. As an executive he is conservative; as a diplomat, effective, and as a motorist, radical."

Ford Helps Detroit Show Gain in May

Increases Output 20,000 While Most Others Fall Off—Reduce Working Forces

DETROIT, June 1—Automobile production in Detroit and the State of Michigan for May totaled 144,601, as compared with 140,955 in April and 142,083 for May last year. The increase over last month was largely due to the Ford output of 101,897 cars and trucks. The April total without Ford was 50,830 and for May, 1920, without Ford was 62,085.

Decreases compared with April were shown by all factories save Ford, Buick, Hudson-Essex, Lincoln, Oakland and Packard. All factories are working short forces but full time in most instances. Dodge was down three days last week, but officials say the plant will be operated full time hereafter in spite of persistent reports that the three-day schedule would continue.

Ford announces that orders ahead of production total more than 100,000 in spite of an output of more than 90,000 in April and more than 100,000 in May. Reports that production had been cut 1000 daily were denied, and it was asserted that no such decrease was in contemplation. Ford officials said it was natural to expect a downward trend to begin late in June, but that everything now points to increasing demand.

Manufacturers See Need for Decision on Prices

NEW YORK, June 2—That every means possible should be taken to stabilize the industry, especially on the question of prices, was the general opinion of manufacturers who attended the annual meeting of the National Automobile Chamber of Commerce here to-day. It was felt that whatever reductions are contemplated in prices should be made at once in fairness to dealers and to the purchasing public.

W. P. G. Harding, governor of the Federal Reserve Board, addressed the members of the N. A. C. C. at noon to-day. He reiterated that there would be no discrimination against automobile paper, even in the Kansas City district, and declared that so far as finances are concerned he can see no reason for anything but optimism for the future.

The members will listen this afternoon to a debate on the problem of unit parts service, to reports on business conditions in all sections of the country and there will be a discussion of the motor truck reimportation question.

It is probable the retiring directors will be re-elected and that at the organization meeting the directors will re-elect Colonel Charles Clifton as president.

The special committee headed by J. Walter Drake which will co-operate with Secretary of Commerce Hoover, will meet with Hoover to-morrow.

Fiat Plant Reopens on Six Hour Basis

Company Successful in Imposing Work Conditions—Stinnes Not Controlling Company

TURIN, ITALY, May 20 (By Mail)—After a lock out lasting 32 days, the Fiat factory has reopened on the conditions imposed by the owners. The works are now running on a 6-hour basis, working 6 days a week. The dispute arose over the claim of the men that they should have a control in shop management and the right to decide when men should be laid off. Rather than accept this the management closed the entire factory, throwing 12,000 hands out of work, and put troops in possession of the entire establishment.

When 8000 men had signed an agreement to accept the disciplinary measure imposed by the directors, and to execute any kind of orders, whether for peace or war, it was decided to open the factory. The general elections which have just taken place completed the downfall of the socialist and communist movement, for the ringleaders who were responsible for the revolutionary outbreak last September failed to secure a majority.

Local trade is in a very depressed condition, with the result that the smaller companies, having few foreign connections, are badly hit. The bigger firms, such as Fiat, Lancia and Isotta-Fraschini, are kept busy on foreign orders. The recent automobile taxes, under which a 35 hp. car pays $3,000 a year at nominal exchange, is having its effect on the industry, and some firms having specialized on big cars up to the present are preparing to produce engines of lower power for next season.

Fiat has opened an automobile factory in Warsaw, Poland, the concern being registered under Polish laws and having a capital of five million Polish marks. Half this capital has been subscribed by Polish financiers and half by Italian interests. Cars and trucks are being produced under the technical direction of the Italian Fiat Co. Business prospects are declared to be good.

The report that Hugo Stinnes had obtained control of the Fiat Automobile Co. is officially denied by that concern, which declares that the German iron king does not hold any stock or have any connections with the leading Italian automobile company. The report seems to have got abroad when Stinnes purchased 20,000 shares in the Alpine Montan Gesselschaft, in which Fiat directors were also holders. The two concerns, however, are entirely distinct.

DIESEL AGENTS NAMED

CHICAGO, May 31—The Dalton-Elliott interests, Wrigley Building, this city, have contracted for the exclusive representation of the Export Gesellschaft fur Deutsche Fabrikate for the North American continent. This carries with it exclusive sales and purchasing representation. The organization is composed of 54 manufacturers in Germany representing practically all lines of industry. It controls a large portion of dye production and, among other products, the Diesel engine. The contract calls for the purchase of raw materials in this country.

Cars Take Second Place in Leading Industries

WASHINGTON, May 31—Automobiles ranked second in the value of products produced in 1919, according to a preliminary statement of the 1920 census of manufacturers, issued to-day. With 315 establishments reporting in 1919, the estimated value of automobiles was $2,387,833,000. This figure is supplemented by 2394 establishments producing automobile bodies and parts to the value of $673,593,000 and 15,486 establishments listed as automobile repairing with production valued at $222,596,000.

The meat packing industry led in the value of products.

These comparative figures illustrate the growth of all branches of the industry, for in 1914 there were only 971 establishments producing automobile bodies and parts with a total production of 129,601,000 and in the same year 3273 automobile repair establishments reported production valued at $29,920,000. Thirty-one establishments manufacturing airplanes, seaplanes, airships and parts in 1919 with a value of $14,373,000 as against 16 establishments in 1914 with production valued at $790,000.

FIRST DUESENBERGS BUILT

INDIANAPOLIS, May 28—The Duesenberg Automobile Co. placed on display in the plant yesterday a roadster, a chassis and a touring car, the first automobiles to be manufactured for sale by the local company, which marks the beginning of production in the first of the three units of the company. The first shipment of automobiles to agents will be made July 1. The six cars entered in the Speedway race were manufactured here, and finishing touches are being put on four racing cars to be entered in the Grand Prix race at LeMans, France, July 26.

TO SELL IMMEL PLANTS

COLUMBUS, May 31—Upon the application of Robert H. Schryver, receiver for the Immel Co., the court ordered the sale of the plant and other assets. The south plant is to be sold for $200,000; the plants on Livingston Avenue for $20,000 and $17,500, and the land at $1200 per acre. All material on hand is to be sold for cash. The preferred stockholders have perfected plans to make a substantial bid for the properties and has made arrangements with J. D. Potter, formerly vice-president of the Kilbourne & Jacobs Co., to head the organization if they secure the plants.

METAL MARKETS

WITH the normally dull period in the steel market ushered in the theme that is in the foreground of discussion is whether there will be a revival of demand in August. In past years when the steel industry suffered from extreme stagnation in the last half of the second and the beginning of the third quarter, it was always August that brought the turn. Optimists among the producers aver that by July the steel market will have reached so moribund a condition that August is certain to bring a reaction. The pessimists say that if the revival does not come in August they will abandon all hope for better conditions during the remainder of the year. Aside from the leading builder of low-priced passenger cars who continues to figure more or less in all departments of the steel market, buying for automotive account is of retail proportions and on the hand-to-mouth order. What little in the way of orders is being placed goes to those mills that have been able to maintain operations on a one-third capacity basis. The reason for this is that those mills which are in operation can make shipments within a few days, while those that are down are prevented from resuming operations until they are fortunate enough to accumulate a sufficient backlog of orders. Prices are extremely soft, and in all transactions that are even remotely representative concessions are the order of the day. Reluctance to shade the nominal quotations is confined to those producers who are not operating anyway. Those who are striving with might and main to keep at least a third of their plants going are more than ready to offer inducements whenever tonnagers and specifications are in the least attractive. The strip steel market reveals sharp cuts by individual mills apparently in an effort to determine whether these concessions will bring out any business. All of the automotive buying of sheets is for instant shipment, and most sheet mills do not know from one day to the next whether they will have enough orders on the morrow to warrant a continuance of operations.

Pig Iron.—Although production continues at famine proportions and the market, if its statistical position governed, should be more than strong, prices are pliable. Even at $23 automotive foundries seem to show little interest. All of the iron for the Ford Motor Co.'s castings is being supplied by its own furnace.

Steel.—New demand for steel bars is light and Chicago bar mills face the end of their backlog of orders...Forging quality bars are being shipped to the Ford Motor Co. by Ohio valley mills that are reported to have taken the business at concessions of $3 per ton. Cold-rolled strip steel is offered in Pittsburgh at 5c. and hot-rolled at 2.55c., compared with 5.50c. and 2.75c., respectively, supposed to be leading producers' quotation. Bolt and nut buying has died down.

Aluminum.—The market continues flat and quotably unaltered.

Copper.—A new copper contract became effective on the New York Metal Exchange June 1. It permits trading in Standard copper, by which term anything running from 96 per cent upward in purity is known. The new contract is designed on the pattern of that in vogue in London and intended to "broaden trading" in copper. If this object is attained, it will mean "outside" speculation which, at times, may bring about artifical conditions that call for extraordinary caution on the part of consuming buyers.

FINANCIAL NOTES

Fisher Body Ohio Co. paid a $2 dividend on the preferred stock May 31. This is the April 1, 1921, dividend, which was suspended until it was determined whether the common stockholders would accept or reject the share exchange offer made by the parent company. The plan was declared operative May 10.

Commonwealth Finance Corp. has declared an extra dividend of one-half of 1 per cent in addition to a quarterly dividend of 1 per cent on its common stock; also a semi-annual dividend of $3.50 a share on its preferred stock, all payable July 15 to holders of record June 30.

Pierce-Arrow Motor Car Co. directors have voted to pass the quarterly dividend on preferred stock due July 1, to conserve the assets of the company during the present period. Quarterly payments of 2 per cent have been made on this issue since Jan. 1, 1917.

Rolls-Royce, Ltd., in a balance sheet for the year ended Oct. 31, 1920, shows net profits of 202,835 pounds sterling, which compares with 192,777 pound for the previous year.

Winfield Barnes Co., Philadelphia, will be sold at receiver's sale, permission for which has been granted by Judge Thompson in United States District Court.

Milwaukee Rolling Mill Co. will increase its capitalization from $1,500,000 to $3,000,000, to provide for expansion.

Auto Car Co. has declared a regular dividend of 1½ per cent payable June 10.

INDUSTRIAL NOTES

C. H. Wheeler Mfg. Co., Philadelphia, manufacturers of pumps, condensers, etc., has opened a new branch office in Boston at 53 State Street.

Stutz Motor Car Co. has started rebuilding the units of the plant destroyed in the recent fire. Production has not been hampered seriously.

Los Angeles Trailer Co., Los Angeles, has changed its name to the Utility Trailer Mfg. Co., with no change in personnel or location.

Marion Plants Find Business Outlook Good

MARION, IND., May 31—Automotive industries of Marion are in fair condition and the future outlook, according to information this week, is for a big increase in production in the next 60 days. Reutenber Motors Corp. is just getting settled into its new plant. It is not in operation. Orders on the books and inquiries that have been received in the last few weeks indicate much new business. The plant will be in operation this fall.

Velie Motors plant, formerly the Rutenber plant, is not in production on power units. It is occupied almost entirely with experimental and laboratory work and it is understood that when production is organized for this fall, a new design of power plant will be announced.

The Indiana truck plant is going steadily on a curtailed schedule. A steady income of orders from Mexico and the Central States is causing preparations for an increased production in June. Most of the new business is coming in from Chicago, Kansas and Texas and is a decided increase over April.

On 50 per cent production now, the Western Drop Forging Co. expects to be in full production on automotive parts within 30 days if business in that time continues as through the last month.

G.M.C. Denies Report of Fusion with Austin

NEW YORK, June 1—The General Motors Corp. denied to-day reports from London that it had been instrumental in arranging a loan for the Austin Motor Co. through W. P. Bonbright & Co. The London report was that there might be a virtual fusion of the British interests with those of General Motors.

Greater credence was given the report because the assistance for Austin came from an unexpected source. It was said at General Motors headquarters, however, that the corporation had no interest in the Austin company beyond a claim for a comparatively small sum for goods furnished. There were reports in London a year ago that Austin was anxious to have General Motors acquire an interest in its business.

Weideley and Midwest Extend Engine Schedules

INDIANAPOLIS, May 28—Officials of the Weideley Motors Co. are planning a production schedule of 14,000 engines for 1921, and in order to produce engines according to the schedule, approximately 4900 tons of raw materials are to be purchased. By the end of the year the company plans to employ about 750 men, or the maximum. An export business of 2 per cent of the output was done by the company last year. The company is selling its product to 22 companies at the present time. It will continue to specialize in engines for automobiles, but intends spending some effort in the development of its tractor department.

A production schedule of 18,000 engines is being planned by officials of the Midwest Engine Co., and it is also planning to get in on the ground floor in the export end of the business. Engines for fifteen concerns are being made by the company and they are planning to have 1800 men employed by Dec. 31.

TO MAKE CAR FOR COAST

LOS ANGELES, June 1—The West Coast Automobile Mfg. Co., organized to manufacture passenger cars, trucks, tractors and trailers in this city, will first bring out an automobile in six and eight-cylinder models, to be known as the Mission. The car will be of featured design and it is proposed to distribute it exclusively on the Pacific Coast. The design of the car above the frame is covered by patents held by Augustus W. King, first vice-president, general manager and designing engineer. The company is incorporated for $1,500,000.

BANK CREDITS

Written exclusively for AUTOMOBILE INDUSTRIES *by the Guaranty Trust Co, second largest bank in America.*

NEW YORK, June 2—The local money market again gave signs of firmness last week. Call money ranged from 6½ per cent to 7½ per cent, as against 6½ per cent to 7 per cent the previous week, with a ruling rate of 7 per cent, which was the renewal rate every day except Tuesday, when 6½ per cent was the renewal figure. On Thursday and Friday 7½ per cent, the highest quoted rate since Feb. 8, was reached during the trading periods. There was little activity in the time money market, where rates were also higher. Sixty and ninety days' and four months' paper were quoted at 6¾ per cent to 7 per cent, as against 6½ per cent to 6¾ per cent the previous week, while five and six months' paper were quoted at 6¼ per cent to 7 per cent, as against 6 per cent to 6½ per cent the previous week. Among the factors having a bearing on the firmer tone in the money market last week were the large Government withdrawals and the preparations for the first-of-the-month's disbursements. In addition, there were in the neighborhood of $150,000,000 in new issues during the week, of which the French 7½'s accounted for $100,000,000.

The Federal Reserve System continued to show the improvement which had been made consistently since the first of the year. The mid-week statement showed increased gold reserves of $14,041,000, and increased cash reserves of $9,098,000. Bills discounted secured by U. S. Government obligations increased $19,082,000, and total bills on hand $33,174,000. Total earning assets, however, declined $50,858,000, almost wholly as a result of decreased holdings of U. S. certificates of indebtedness. Total deposits declined $10,686,000 and Federal Reserve notes in circulation $32,611,000. As a result of these changes, the ratio of total reserves to deposit and Federal Reserve note liabilities combined increased from 56.8 per cent to 57.6.

Foreign Exchange Irregular

The foreign situation is still clouded, with the exact method of the payment of the German reparations undetermined. This uncertainty was reflected in the foreign exchange market, where rates were irregular and tending to decline. The British pound dropped to more than 13 cents below the recent high for the current year. The announcement of further dividend cuts by prominent industrial corporations was probably in part responsible for the lower prices for industrial shares. Railroad shares, on the other hand, showed some resistance to the downward movement on the strength of rather favorable earnings statements for the month of April, published last week, which, taken in conjunction with the wage cuts which are expected to take effect July 1, had a bolstering effect on the market.

MEN OF THE INDUSTRY

Charles W. Churchill, until recently general manager of the Winton Co., Cleveland, has joined the sales organization of the Buick Motor Co. In his new work with Buick Churchill will be closely associated with E. T. Strong, general sales manager, with headquarters at the main office in Flint. Churchill rose from retail salesman to general manager of the Winton company. In 1904 he became identified with Winton, where he gained valuable first-hand experience in selling cars. In 1906 he was made eastern manager of the company with headquarters in New York. His success in New York was so marked that after two years' experience as a branch manager he was recalled to Cleveland to take over the direction of the entire sales force. As general sales manager, the high calibre of his judgment and executive ability was evidenced and in 1915 he was promoted to general manager of the complete Winton organization, which position he held until joining Buick. Churchill has been a director of the National Automobile Chamber of Commerce for some time and has been chairman of the membership committee as well as chairman of the patents committee.

J. S. Garlent has been named factory manager of the Auto Wheel and Gier Pressed Steel units of the Motor Wheel Corp., at Lansing. Garlent joined the organization a year and a half ago, previous to which time he was factory superintendent for the King Motor Car Co.

Le Roy J. Williams has resigned as counsel and assistant to the general manager of the Lincoln Motor Co. He had been associated with the Lelands for the past six years.

Langdon A. Smith has been appointed vice-president and director of sales for the American Motors Corp., Plainfield, N. J., manufacturers of the American car. He has been connected with Maxwell-Chalmers interests for several years, latterly being assistant director of sales for the combined companies. D. M. Kingley has been appointed manager of the American's New York branch. He was vice-president and sales manager of Holmes and before that was associated with Locomobile.

C. W. Butterfield has been appointed sales manager of the Apex Motor Corp. He was sales manager of the Herschell-Spillman Motor Co., and also served for several years as sales and service manager of the Dyneto Electric Corp., Syracuse.

E. J. Mueller has been named director of sales and advertising of the Cleveland Motorcycle Mfg. Co. He had been connected with Harley-Davidson Motor Co. for eleven years, the last five as sales manager.

H. S. Dart, advertising manager for the Paige Motor Car Co., has resigned effective immediately. He has not announced his future plans.

O. L. Weaver has resigned as sales manager of the Star Rubber Co., because of ill health, but will continue as a director and secretary. A. G. Partridge, formerly vice-president and general sales manager of Firestone, has been named vice-president and sales manager of the Star company.

John T. Bowers has been appointed commercial manager of the Columbia Motors Co., Detroit. This is his first service in the automotive field, his sales experience to date having been almost exclusively in piano merchandising.

Wilson Bailey, formerly Eastern sales manager for the Gary Motor Truck Co., Gary, Ind., is now Eastern district manager of the Trackless Transportation Corp., New York.

W. C. Sills Resigns as Chevrolet Sales Chief

NEW YORK, June 1.—The Chevrolet Motor Co. announces the resignation of W. C. Sills as general manager of sales, effective to-day. Sills began his connection with Chevrolet in 1912, when he resigned from the Buick Motor Co. as assistant New England manager and started the distribution of Chevrolet cars in Boston and New England.

He moved to New York in 1914 and assumed the general direction of sales for the Chevrolet company. He has been, in a large measure, responsible for building up the strong organization now marketing the Chevrolet product.

Sills will return to Boston on Aug. 1 and resume distribution of Chevrolet cars in New England. He will be succeeded by Colin Campbell, who has been executive assistant to the general manager of sales for more than five years.

Colonel Cardway Resigns as Packard Export Head

NEW YORK, June 1—Colonel Fred Cardway has resigned as vice-president and general manager and director of the Packard Motors Export Corp. to devote all his time to personal interests. He has been a leading factor in the upbuilding of Packard international trade and his achievements have earned him a reputation as "one of the world's great business diplomats and psychologists."

Paul D. Davis, advertising manager, who for several years has been identified with the export sales promotion and advertising activities of Packard and the Firestone Tire & Rubber Co., has also submitted his resignation, as have Charles A. Cobb, assistant sales manager, and Paul F. Mulvey, secretary to Col. Cardway.

Rice Outlines Policies at Testimonial Dinner

DETROIT, May 27—H. H. Rice, who succeeded R. H. Collins as president and general manager of the Cadillac Motor Car Co., was guest of honor last night at a dinner in the dining room of the new Cadillac plant at which 400 of his co-workers were present. The meeting was presided over by G. H. Layng, vice-president of the Cadillac, and the committee in charge of the affair included C. M. Carson, industrial manager; F. A. Tresler, office manager, and J. A. Cleary, advertising manager.

All of the administrative officials, heads of the various departments throughout the factory, as well as foremen and assistant foremen, were present. The affair took the nature of a get-acquainted, get-together dinner, and Rice took occasion to outline some of the plans that would guide him in his efforts as the head of the Cadillac company.

Receivers Are Named for Portage Rubber

AKRON, June 1—George D. Bates and J. W. McGuire have been named receivers for the Portage Rubber Co. on a petition in bankruptcy filed against it by the Wellman, Seaver Morgan Co., which has a claim for $22,266. Total liabilities are listed at $1,700,000.

The receivership follows a hitch in the refinancing plans of the company. Creditors refused to assent to a plan of readjustment. The failure is due largely to heavy inventory shrinkage on raw materials and contractual losses for fabric and rubber.

Force Reduction Causes Lafayette to Sell Homes

INDIANAPOLIS, May 31—A group of fifty-six houses built by the Lafayette Building Co. here have been placed on sale by the company. The houses were primarily built for employees of the Lafayette Motors Co., of which the building company is a subsidiary organization, but because the plant has been forced to cut its force the houses are to be offered publicly for sale.

The houses are being sold for $1000 under the actual cash price and in some instances a greater loss is being taken. It is estimated that the company has suffered a loss of about $100,000 on the entire group, but it is thought that with a colony established the company will be able to utilize the remainder of the lots for building purposes and absorb the loss on their first group of houses.

The Union City Body Co. at Union City, Ind., is planning the construction of from twenty to forty houses on a site near its factory for employees, the houses to be sold on payments. The company plans to have the houses completed by fall.

TRUCK DIRECTORS TO MEET

DETROIT, May 28—Directors of the National Association of Motor Truck Sales Managers will meet June 7 to discuss improved sales methods among motor truck dealers and outline a plan of campaign to bring about a better understanding. Fred Glover, general manager of the Timken-Detroit Axle Co., and G. W. Yoeman, vice-president of Continental Motors, will attend the meeting and address the directors. Many reports that have reached the association headquarters regarding the activities of some dealers not in accord with good business principles, resulted in the decision of the directors to make an effort to bring about betterment through persuasive methods, if possible. In the event of failure, drastic measures will be taken, it is said, to bring such practices ito an end.

Calendar

SHOWS

Sept. 5-10—Indianapolis, Automobile and Accessory Show in conjunction with Indiana State Fair, conducted by Indianapolis Automobile Trade Association, John B. Orman, Mgr.

Sept. 28 - Oct. 8 — New York, Electrical Exposition, 71st Regt. Armory, Electric Equipment, Machinery and Vehicles.

Nov. 27-Dec. 3—New York, Automobile Salon, Hotel Commodore.

January — Chicago, Automobile Salon, Hotel Drake.

FOREIGN SHOWS

June, 1921—Reykjavik, Iceland, Agricultural Exhibition—Agricultural Machinery—Icelander Agricultural Society, Reykjavik, Iceland.

September—Buenos Aires, Argentina, Passenger Cars and Equipment. La Pabellon de las Rosas. Automovil Club Argentino.

September—Buenos Aires, Argentina, Cars, Trucks, Tractors, Farm Lighting Plants and Power Farming Machinery. Palermo Park; Sociedad Rural Argentina.

September—Luxemburg, Luxemburg, Agricultural Sample Exhibition.

Oct. 5-16—Paris, France, Paris Motor Show, Grand Palais, Administration de l'Exposition Internationale de l'Automobile, 51, Rue Pergolèse, Paris.

Nov. 4-12 — London, British Motor Show, Society Motor Mfrs. and Traders.

May, 1922—Quito, Ecuador, Agricultural Exposition, celebrating Centenary of Ecuador. Automotive Section.

CONVENTIONS

July 4-9 — Mackinac Island, Mich., Summer Meeting Automotive Equipment Association.

Oct. 12-14, 1921 — Chicago, Twenty-eighth Annual Convention National Implement & Vehicle A'ssn.

Nov. 22—New York, Convention of Factory Service Managers, National Automobile Chamber of Commerce.

RACES

June 18—Uniontown, Pa., Speedway Events.

July 25—Grand Prix, Le Mans.

Labor Day—Uniontown, Pa., Autumn Classic.

Death of Batchelder Shock to Motordom

(*Continued from page* 1186)

Batchelder was born at Akron, N. Y., 52 years ago, and was educated at Attica, N. Y. He began life as a printer at Attica and one of his cherished possessions was a gold plated printer's stick. After learning his trade in Attica he went to Buffalo and became a compositor on the Buffalo *Courier*. He was an enthusiast on sports and became sporting editor of the *Courier*. His page was widely quoted and he was regarded as an expert in various branches of sport. But his chief interest was in bicycles.

He came to New York 27 years ago as a handicapper for the League of American Wheelmen. He also served as bicycle editor of the New York *American* at a time when cycling was in its heyday. Four or five years after coming to this city he was made chairman of the National Cycling Association, which controlled racing throughout the country.

Just as he had been a pioneer in the promotion of the bicycle, Batchelder became one of the first automobile enthusiasts in the days when few foresaw the future of the motor vehicle. He studied automobiles thoroughly and made the acquaintance of the men who did most to develop the industry in its early days. He was one of the first to grasp the importance of highways.

When Alfred Reeves resigned as automobile editor of the *Evening Mail* his position was taken by Batchelder, who later became editor of *The Automobile* and then took up his work with the A. A. A., which then was an infant organization.

Batchelder took with him into the development of the national association of motorists the enthusiasm which had marked his entire career. While intensely interested in every activity and development which related to motor vehicles he concentrated his major energies on highways and soon became one of the foremost exponents of this subject.

Just as Batchelder had progressed from the bicycle to the automobile, he was turning to aviation. He had visions of great national highways gridironing the country to be utilized by aviators and motorists alike. He had long contended that aviators could follow these roads and that they should be lined from coast to coast and from border to border with landing places. One of the principal speakers at the annual dinner of the A. A. A. at Washington two weeks ago was Brigadier General Mitchell of the Army Air Service who advocated the building of landing fields. It probably was the lack of a suitable field upon which to land that cost Batchelder and his companions their lives on the ill-fated flight from Washington to Langley Field in a Curtiss Eagle ambulance airplane in a terrific electrical storm.

Steel Tread Tires Pass Out in France

(*Continued from page* 1181)

of leather used for receiving the steel rivets. The curious feature is that without any publicity campaign the French motoring public should have been induced to abandon a type of tire which not long ago was considered essential.

Clincher bead tires still hold the market, with no likelihood of their immediate abandonment in favor of the straight side. Michelin, the biggest manufacturer in France, is conducting a campaign against the straight side and has circularized all his dealers to fight it. According to reliable information, however, Michelin has a straight side tire ready to be put on the market if the move is considered advisable.

At the present time this change could only be made at immense expense and with the aid of a big propaganda campaign, for the public would refuse to buy cars with straight side equipment unless assured that supplies could be obtained in all parts of the country. There was a certain possibility of straight side tires getting a footing in France by reason of American army automobiles being put on the market, together with stocks of American tires. This opportunity has been lost, however.

PACKARD AWARDS WATCHES

DETROIT, May 28—The Packard Motor Car Co. Wednesday night presented to each of its employees who had served ten years or more a gold watch, among the recipients being President Alvan Macauley.

Shippers Association Invites Automotive Men

PITTSBURGH, May 28 — Manufacturers of automobiles and automotive equipment, who make use of the public merchandise warehouse in distributing their products, will be interested in the annual meeting of the Shippers' Warehousing & Distributing Association to be held at the William Penn Hotel here on June 16 and 17.

The association was organized last June by manufacturing interests which route their goods from factory to retailer and consumer by way of the public warehouse. The warehouse industry itself has for thirty years had a national organization, the American Warehousemen's Association, but shippers who had business dealings with that industry had no organized means of adjusting differences with warehousemen. The recognized need of standardization of documents and practices in this business relationship has attracted to the shippers' body such companies as the Westinghouse Electric & Manufacturing Co., American Sugar Refining Co., Colgate & Co., Lever Brothers Co., De Laval Separator Co., Horlick's Malted Milk Co., Kellogg Toasted Corn Flake Co., Procter & Gamble Distributing Co. and others.

Automotive interests which use public warehouses are eligible to membership and their representatives will be welcomed at the convention. Information regarding the program may be obtained by addressing the association's secretary, Kent B. Stiles, editor of *Distribution and Warehousing*, 239 West 39th Street, New York.

WILLYS MOVES EXPORT OFFICE

NEW YORK, May 31—Removal of the administrative offices of the John N. Willys Export Corp. from 165 Broadway to the Willys headquarters at Toledo on June 15 was announced by the company here to-day. A branch office will be maintained at New York but the export business will be directed from Toledo by E. C. Morse, vice-president and general manager. The export corporation will be continued and will not be merged into any of the other Willys subsidiaries. The company handles foreign sales on all the products of the Willys companies.